Deutsches Institut für Bautechnik DIBt

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

European Technical Assessment ETA-15/0882 of 11 December 2017

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
Product family to which the construction product belongs	Bonded anchor for use in concrete
Manufacturer	Hilti AG Feldkircherstraße 100 9494 Schaan FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Werke
This European Technical Assessment contains	26 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	ETA 001 Part 5: "Bonded anchors", April 2013, used as EAD according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011.
This version replaces	ETA-15/0882 issued on 22 April 2016

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Specific Part

1 Technical description of the product

The "Injection System Hilti HIT-RE 100" is a bonded anchor consisting of a foil pack with injection mortar Hilti HIT-RE 100 and a steel element. The elements are made of reinforcing bar, zinc coated steel (threaded rods HIT-V and HAS-(E)), stainless steel (threaded rods HIT-V-R, HAS-(E)R and tension anchor HZA-R) or high corrosion resistant steel (threaded rods HIT-V-HCR and HAS-(E)HCR).

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between steel element, 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 for static and quasi-static action, displacements	See Annex C1 to C9

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	No performance assessed

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances there may be requirements (e.g. transposed European legislation and national laws, regulations and administrative provisions) applicable to the products falling within the scope of this European Technical Assessment. In order to meet the provisions of Regulation (EU) No 305/2011, these requirements need also to be complied with, when and where they apply.

3.4 Safety in use (BWR 4)

The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

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

In accordance with guideline for European technical approval ETAG 001, April 2013 used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 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 11 December 2017 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)…

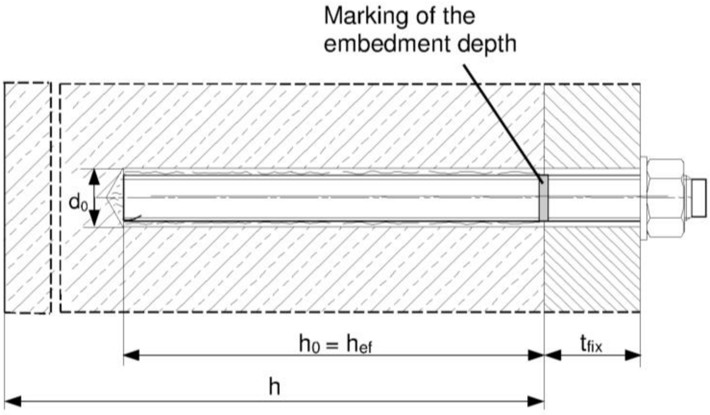
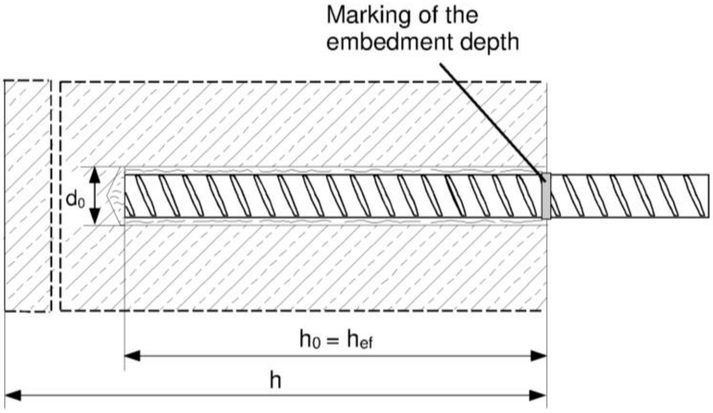


Figure A2:
Reinforcing bar (rebar)



Product description: Injection mortar and steel elements

Injection mortar Hilti HIT-RE 100: hybrid system with aggregate

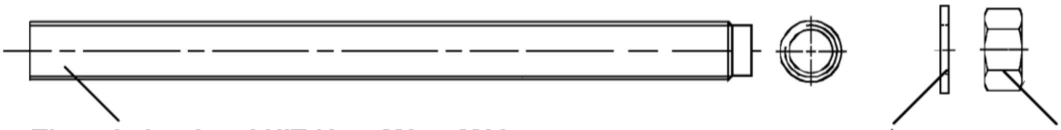
330 ml, 500 ml and 1400 ml

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

Product name: “Hilti HIT-RE 100”

Static mixer Hilti HIT-RE-M

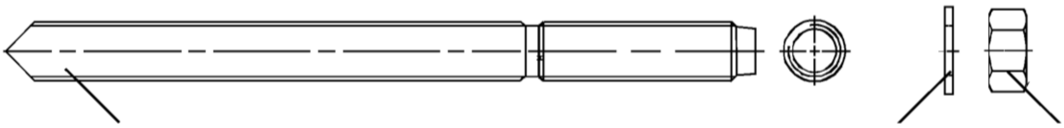
Steel elements



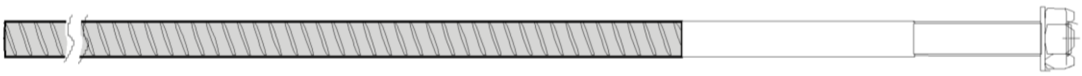
Threaded rod and HIT-V-...: M8 to M30 washer nut

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



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 Table B4.

Injection system Hilti HIT-RE 100	**Annex A2**
Product description Injection mortar / Static mixer / 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 II 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 Elongation at fracture (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 Elongation at fracture (l_0 = 5d) > 12% ductile Electroplated zinc coated ≥ 5 μm, (F) 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, 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 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
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
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, Elongation at fracture (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

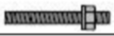
Specifications of intended use

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.
- Cracked and non-cracked 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 100 with …			
Elements		HIT-V-… 	HAS-(E)-… 	HZA-R 	Rebar 
Hammer drilling with hollow drill bit TE-CD or TE-YD 		✓	✓	✓	✓
Hammer drilling 		✓	✓	✓	✓
Use category	Dry or wet concrete	✓	✓	✓	✓
	Flooded hole (no sea water)	✓	✓	✓	✓
Static and quasi static loading in non-cracked concrete		M8 to M30	M8 to M30	M12 to M24	ϕ 8 to ϕ 32
Static and quasi static loading in cracked concrete		M10 to M30	M10 to M30	M12 to M24	ϕ 10 to ϕ 32

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:
  “EOTA Technical Report TR 029, 09/2010” or “CEN/TS 1992-4:2009”

Installation:

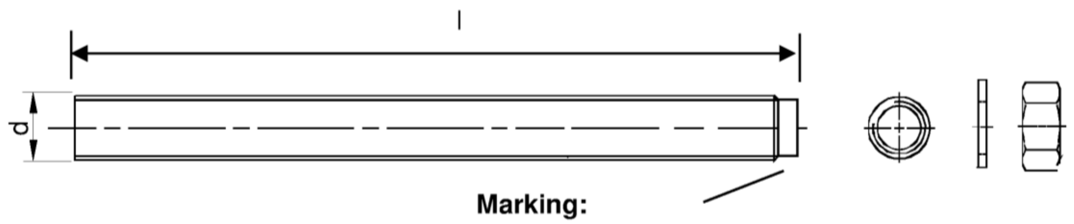
- Use category: dry or wet concrete or in flooded holes
- Overhead installation is admissible.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

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 element	$d^{1)} = d_{nom}^{2)}$	[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]	60 to 160	60 to 200	70 to 240	80 to 320	90 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 [3]	d_f	[mm]	9	12	14	18	22	26	30	33
Minimum thickness of concrete member	h_{min}	[mm]	h_{ef} + 30 ≥ 100 mm			$h_{ef} + 2 \cdot d_0$				
Maximum torque moment	T_{max}	[Nm]	10	20	40	80	150	200	270	300
Minimum spacing	s_{min}	[mm]	40	50	60	80	100	120	135	150
Minimum edge distance	c_{min}	[mm]	40	50	60	80	100	120	135	150

1) Parameter for design according to "EOTA Technical Report TR 029".
2) Parameter for design according to "CEN/TS 1992-4:2009".
3) For larger clearance hole see TR 029, section 1.1.

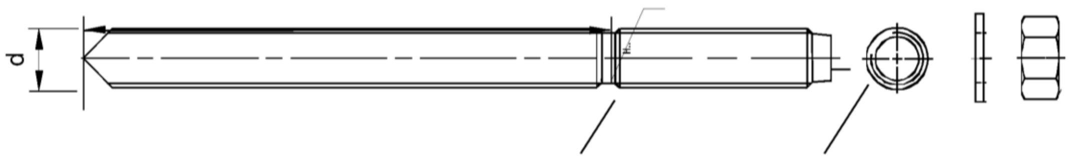
HIT-V-…



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

Injection system Hilti HIT-RE 100

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

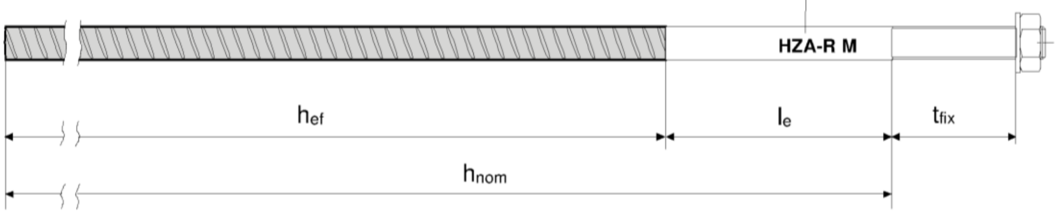
Annex B3

Table B3: 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	24[2] / 25	30[2] / 32
Maximum diameter of clearance hole in the fixture [1]	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 spacing	s_{min}	[mm]	65	80	100	130
Minimum edge distance	c_{min}	[mm]	45	50	55	60

[1] For larger clearance hole see TR 029, section 1.1.
[2] Each of the two given values can be used.

Marking:
embossing "HZA-R" M .. / t_{fix}



Injection system Hilti HIT-RE 100

Intended Use
Installation parameters of Hilti tension anchor HZA-R

Annex B4

Table B4: 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 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	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 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)

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Table B5: Maximum working time and minimum curing time [1)]

Temperature in the base material T	Maximum working time t_{work}	Minimum curing time t_{cure}
5 °C to 9 °C	2 hours	72 hours
10 °C to 14 °C	1,5 hours	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

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

Table B6: Parameters of cleaning and setting tools

Elements			Drill and clean			Installation
Threaded rod, HIT-V-… HAS-(E)…	HZA-R	Rebar	Hammer drilling	Hollow drill bit TE-CD, TE-YD	Brush	Piston plug
						
size	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	-	ϕ 10, ϕ 12	14	14	14	14
-	M12	ϕ 12	16	16	16	16
M16	-	ϕ 14	18	18	18	18
-	M16	ϕ 16	20	20	20	20
M20	-	-	22	22	22	22
-	M20[1)]	ϕ 20[1)]	24[1)]	24[1)]	24	24
-	M20	ϕ 20	25	25	25	25
M24	-	-	28	28	28	28
M27	-	ϕ 25[1)]	30[1)]	-	30[1)]	30[1)]
-	M24	ϕ 25, ϕ 26	32	32	32	32
M30	-	ϕ 28	35	-	35	35
-	-	ϕ 30	37	-	37	37
-	-	ϕ 32	40	-	40	40

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

Injection system Hilti HIT-RE 100

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

Annex B6

Cleaning alternatives

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

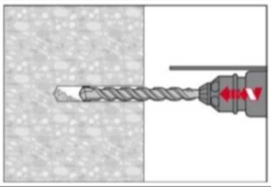
Compressed Air Cleaning (CAC):
Air nozzle with an orifice opening of minimum 3,5 mm in diameter.

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

Installation instruction

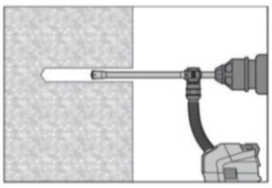
Hole drilling

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: For dry and wet concrete only.

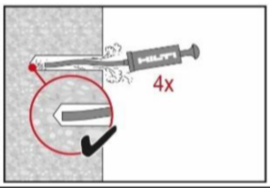


Drill hole to the required embedment depth with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit with Hilti vacuum attachment. This drilling system removes the dust and cleans the drill hole during drilling when used in accordance with the user's manual. After drilling is completed, proceed to the "injection preparation" step in the installation instruction.

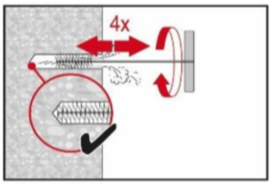
Drill hole cleaning Just before setting an anchor, the drill hole must be free of dust and debris. Inadequate hole cleaning = poor load values.

Injection system Hilti HIT-RE 100	**Annex B7**
Intended Use Cleaning and setting tools Installation instructions	

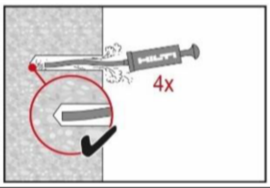
Manual Cleaning (MC) **non-cracked concrete only** for drill hole diameters $d_0 \leq 20$ mm and drill hole depths $h_0 \leq 10 \cdot d$



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.

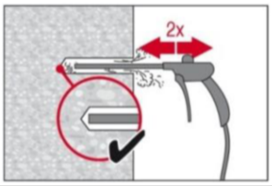


Brush 4 times with the specified brush (see Table B6) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.

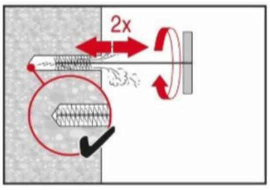


Blow out again with the Hilti hand pump at least 4 times until return air stream is free of noticeable dust.

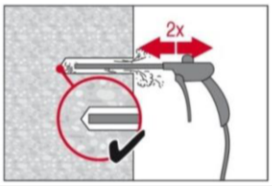
Compressed Air Cleaning (CAC) for all drill hole diameters d_0 and all drill hole depths h_0



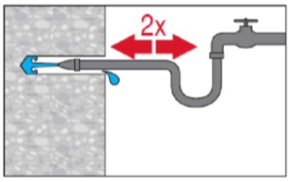
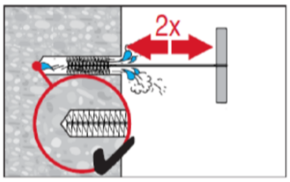
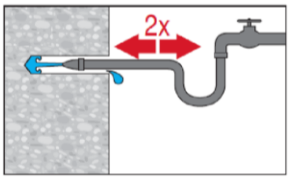
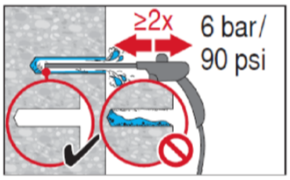
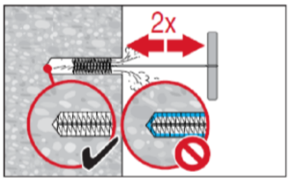
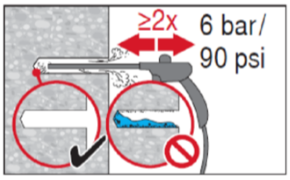
Blow 2 times from the back of the hole (if needed with nozzle extension) over the hole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust.
For drill hole diameters ≥ 32 mm the compressor has to supply a minimum air flow of 140 m³/h.



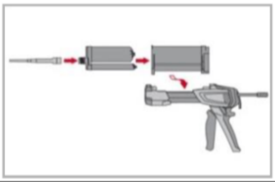
Brush 2 times with the specified brush (see Table B6) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.



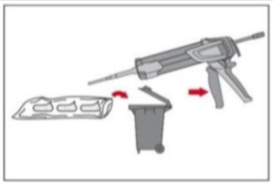
Blow again with compressed air 2 times until return air stream is free of noticeable dust.

Cleaning of flooded 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 size (brush Ø ≥ drill hole Ø, see Table B6) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole – 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 hole length with oil-free compressed air (min. 6 bar at 6 m^3/h) until return air stream is free of noticeable dust and water. For drill hole diameters ≥ 32 mm the compressor must supply a minimum air flow of 140 m^3/h.
	Brush 2 times with the specified brush size (brush Ø ≥ drill hole Ø, see Table B6) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it The brush must produce natural resistance as it enters the drill hole – 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 preparation



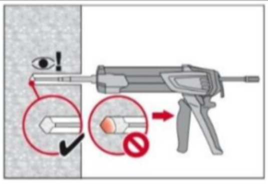
Tightly attach new Hilti mixing nozzle HIT-RE-M to foil pack manifold (snug fit). Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser.
Check foil pack holder for proper function. Do not use damaged foil packs / holders.
Insert foil pack into foil pack holder and put holder into HIT-dispenser.



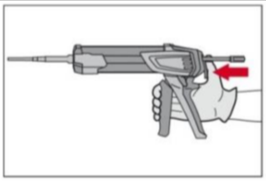
Discard initial adhesive. The foil pack opens automatically as dispensing is initiated.
Depending on the size of the foil pack an initial amount of adhesive has to be discarded.
Discarded quantities are

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

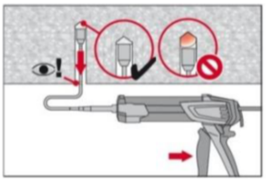
Inject adhesive from the back of the drill hole without forming air voids.



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.

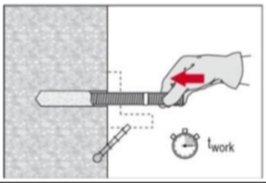


After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

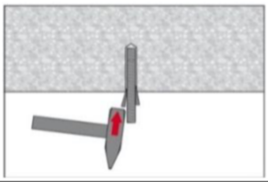


Overhead installation and/or installation with embedment depth h_{ef} > 250mm.
For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug (see Table B6). Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure.

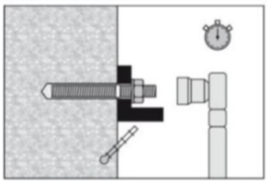
Setting the element



Before use, verify that the element is dry and free of oil and other contaminants.
Mark and set element to the required embedment depth until working time t_{work} has elapsed. The working time t_{work} is given in Table B5.



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 B5) the anchor can be loaded.
The applied installation torque shall not exceed the values T_{max} given in Table B2 to Table B3.

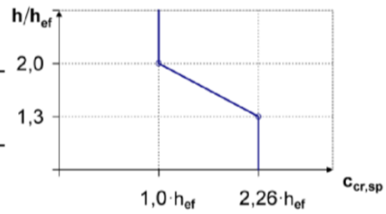
Injection system Hilti HIT-RE 100

Intended Use
Installation instructions

Annex B10

Deutsches Institut für Bautechnik DIBt

Table C1: Characteristic values of resistance for threaded rod, HIT-V-… and HAS-(E)… under tension load in concrete

<table>
<tr><th colspan="3">HIT-RE 100 with threaded rod, HIT-V-… and HAS-(E)…</th><th>M8</th><th>M10</th><th>M12</th><th>M16</th><th>M20</th><th>M24</th><th>M27</th><th>M30</th></tr>
<tr><td>Installation safety factor</td><td>γ_2 [1] = γ_{inst} [2]</td><td>[-]</td><td colspan="8">1,4</td></tr>
<tr><td colspan="11">Steel failure</td></tr>
<tr><td>Characteristic steel resistance</td><td>$N_{Rk,s}$</td><td>[kN]</td><td colspan="8">$A_s \cdot f_{uk}$</td></tr>
<tr><td colspan="11">Combined pullout and concrete cone failure</td></tr>
<tr><td colspan="11">Characteristic bond resistance in non-cracked concrete C20/25</td></tr>
<tr><td>Temperature range I: 40 °C/24 °C</td><td>$\tau_{Rk,ucr}$</td><td>[N/mm²]</td><td colspan="3">15</td><td colspan="2">14</td><td colspan="3">12</td></tr>
<tr><td>Temperature range II: 58 °C/35 °C</td><td>$\tau_{Rk,ucr}$</td><td>[N/mm²]</td><td colspan="3">10</td><td colspan="2">9</td><td colspan="3">8,5</td></tr>
<tr><td>Temperature range III: 70 °C/43 °C</td><td>$\tau_{Rk,ucr}$</td><td>[N/mm²]</td><td colspan="3">6</td><td colspan="2">5,5</td><td colspan="3">5</td></tr>
<tr><td>Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5</td><td>$k_8 = k_{ucr}$ [2]</td><td>[-]</td><td colspan="8">10,1</td></tr>
<tr><td colspan="11">Characteristic bond resistance in cracked concrete C20/25</td></tr>
<tr><td>Temperature range I: 40 °C/24 °C</td><td>$\tau_{Rk,cr}$</td><td>[N/mm²]</td><td>-</td><td colspan="2">7</td><td>6,5</td><td colspan="2">6</td><td colspan="2">5,5</td></tr>
<tr><td>Temperature range II: 58 °C/35 °C</td><td>$\tau_{Rk,cr}$</td><td>[N/mm²]</td><td>-</td><td colspan="3">4,5</td><td colspan="2">4</td><td colspan="2">3,5</td></tr>
<tr><td>Temperature range III: 70 °C/43 °C</td><td>$\tau_{Rk,cr}$</td><td>[N/mm²]</td><td>-</td><td colspan="3">2,5</td><td colspan="4">2</td></tr>
<tr><td>Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5</td><td>$k_8 = k_{cr}$ [2]</td><td>[-]</td><td colspan="8">7,2</td></tr>
<tr><td rowspan="3">Increasing factors for τ_{Rk} in concrete</td><td rowspan="3">ψ_c</td><td>C30/37</td><td colspan="8">1,00</td></tr>
<tr><td>C40/50</td><td colspan="8">1,00</td></tr>
<tr><td>C50/60</td><td colspan="8">1,00</td></tr>
<tr><td colspan="11">Splitting failure</td></tr>
<tr><td rowspan="3">Edge distance $c_{cr,sp}$ [mm] for</td><td colspan="2">$h / h_{ef} \geq 2,0$</td><td colspan="3">$1,0 \cdot h_{ef}$</td><td colspan="5" rowspan="3">
</td></tr>
<tr><td colspan="2">$2,0 > h / h_{ef} > 1,3$</td><td colspan="3">$4,6\ h_{ef} - 1,8\ h$</td></tr>
<tr><td colspan="2">$h / h_{ef} \leq 1,3$</td><td colspan="3">$2,26\ h_{ef}$</td></tr>
<tr><td>Spacing</td><td>$s_{cr,sp}$</td><td>[mm]</td><td colspan="8">$2 \cdot c_{cr,sp}$</td></tr>
</table>

[1] Parameter for design according to EOTA Technical Report TR 029.
[2] Parameter for design according to CEN/TS 1992-4:2009.

Injection system Hilti HIT-RE 100

Performances
Characteristic values of resistance under tension and shear loads in concrete
Design according to „EOTA Technical Report TR 029, 09/2010“or “CEN/TS 1992-4:2009”

Annex C1

Table C2: Characteristic values of resistance for threaded rod, HIT-V-… and HAS-(E)… under shear loads

HIT-RE 100 with threaded rod, HIT-V-… and HAS-(E)…			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm										
Factor according to section 6.3.2.1 of CEN/TS 1992-4: 2009 part 5	k_2[2)]	[-]	1,0							
Characteristic steel resistance	$V_{Rk,s}$	[kN]	$0,5 \cdot A_s \cdot f_{uk}$							
Steel failure with lever arm										
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$							
Concrete pry-out failure										
Factor acc. to equation (5.7) of TR 029 or acc. to equation (27) of CEN/TS 1992-4: 2009 part 5	k[1)] = k_3[2)]	[-]	2,0							

[1)] Parameter for design according to EOTA Technical Report TR 029.
[2)] Parameter for design according to CEN/TS 1992-4:2009.

Table C3: Displacements under tension load for threaded rod, HIT-V-… and HAS-(E)…

HIT-RE 100 with threaded rod, HIT-V-… and HAS-(E)…			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete temperature range I : 40°C / 24°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,02		0,03	0,04	0,05	0,06		0,07
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,04	0,05	0,06	0,08	0,11	0,13	0,15	0,17
Non-cracked concrete temperature range II : 58°C / 35°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,03	0,04	0,05	0,07	0,09	0,11	0,13	0,14
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,07	0,09	0,10	0,14	0,18	0,22	0,25	0,28
Non-cracked concrete temperature range III : 70°C / 43°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,07	0,09	0,10	0,14	0,18	0,22	0,25	0,28
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,09	0,12	0,15	0,20	0,26	0,31	0,35	0,40
Cracked concrete temperature range I : 40°C / 24°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	-	0,04	0,05		0,06	0,07	0,08	
	$\delta_{N\infty}$	[mm/(N/mm²)]	-	0,23						
Cracked concrete temperature range II : 58°C / 35°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	-	0,08	0,09	0,11	0,13	0,14	0,15	0,17
	$\delta_{N\infty}$	[mm/(N/mm²)]	-	0,38						
Cracked concrete temperature range III : 70°C / 43°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	-	0,16	0,18	0,22	0,25	0,28	0,31	0,33
	$\delta_{N\infty}$	[mm/(N/mm²)]	-	0,54						

Table C4: Displacements under shear load for threaded rod, HIT-V-… and HAS-(E)…

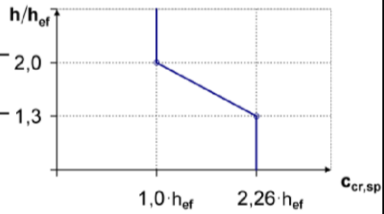
HIT-RE 100 with threaded rod, HIT-V-… and HAS-(E)…			M8	M10	M12	M16	M20	M24	M27	M30
Displacement	δ_{N0}	[mm/(N/mm²)]	0,06		0,05	0,04		0,03		
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,09	0,08		0,06		0,05		

Table C5: Characteristic values of resistance for Hilti tension anchor HZA-R under tension loads in concrete

Hilti HIT-RE 100 with HZA-R			**M12**	**M16**	**M20**	**M24**
Installation safety factor	γ_2 2) = γ_{inst} 3)	[-]	1,4			
Steel failure						
Characteristic resistance HZA-R	$N_{Rk,s}$	[kN]	62	111	173	248
Partial safety factor	γ_{Ms} 1)	[-]	1,4			
Combined pull-out and concrete cone failure						
Diameter of rebar	d	[mm]	12	16	20	25
Characteristic bond resistance in non-cracked concrete C20/25						
Temperature range I: 40 °C/24 °C	$\tau_{Rk,ucr}$	[N/mm²]	14	12		11
Temperature range II: 58 °C/35 °C	$\tau_{Rk,ucr}$	[N/mm²]	9	8		7
Temperature range III: 70 °C/43 °C	$\tau_{Rk,ucr}$	[N/mm²]	5,5		5	
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5	$k_8 = k_{ucr}$ 3)	[-]	10,1			
Characteristic bond resistance in cracked concrete C20/25						
Temperature range I: 40 °C/24 °C	$\tau_{Rk,cr}$	[N/mm²]	7	6,5	6	
Temperature range II: 58 °C/35 °C	$\tau_{Rk,cr}$	[N/mm²]	4,5	4		
Temperature range III: 70 °C/43 °C	$\tau_{Rk,cr}$	[N/mm²]	2,5		2	
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5	$k_8 = k_{cr}$ 3)	[-]	7,2			
Increasing factor for τ_{Rk} in concrete	ψ_c	C30/37	1,00			
		C40/50	1,00			
		C50/60	1,00			

Table C5: continued

Effective anchorage depth for calculation of $N^0_{Rk,p}$ acc. Eq. 5.2a (TR 029, 5.2.2.3 Combined pull - out and concrete cone failure)	HZA-R	h_{ef}	[mm]	$h_{nom} - 100$
Concrete cone failure				
Effective anchorage depth for calculation of $N^0_{Rk,c}$ acc. Eq. 5.3a (TR 029, 5.2.2.4 Concrete cone failure)	HZA-R	h_{ef}	[mm]	h_{nom}
Splitting failure relevant for non-cracked 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]	$2 \cdot c_{cr,sp}$



1) In absence of national regulations.
2) Parameter for design according to EOTA Technical Report TR 029.
3) Parameter for design according to CEN/TS 1992-4:2009.

Table C6: Characteristic values of resistance for Hilti tension anchor HZA-R under shear loads in concrete

Hilti HIT-RE 100 with HZA-R			**M12**	**M16**	**M20**	**M24**
Steel failure without lever arm						
Factor according to section 6.3.2.1 of CEN/TS 1992-4: 2009 part 5	k_2 3)	[-]	1,0			
Characteristic resistance HZA-R	$V_{Rk,s}$	[kN]	31	55	86	124
Partial safety factor	γ_{Ms} 1)	[-]	1,5			
Steel failure with lever arm						
Characteristic resistance HZA-R	$M^0_{Rk,s}$	[Nm]	97	234	457	790
Partial safety factor	γ_{Ms} 1)	[-]	1,5			
Concrete pry-out failure						
Factor acc. to equation (5.7) of TR 029 or acc. to equation (27) of CEN/TS 1992-4: 2009 part 5	k 2) $= k_3$ 3)	[-]	2,0			

1) In absence of national regulations.
2) Parameter for design according to EOTA Technical Report TR 029.
3) Parameter for design according to CEN/TS 1992-4:2009.

Injection system Hilti HIT-RE 100	**Annex C5**
Performances Characteristic values of resistance under tension loads and under shear loads in concrete. Design according to „EOTA Technical Report TR 029, 09/2010“or “CEN/TS 1992-4:2009”	

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Table C7: Displacements under tension load

Hilti HIT-RE 100-A with HZA-R			M12	M16	M20	M24
Non-cracked 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)]	0,06	0,08	0,11	0,14
Non-cracked concrete temperature range II : 58°C / 35°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,05	0,07	0,09	0,12
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,10	0,14	0,18	0,23
Non-cracked concrete temperature range III : 70°C / 43°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,10	0,14	0,18	0,23
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,20	0,26	0,33
Cracked concrete temperature range I : 40°C / 24°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,05		0,06	0,07
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,23			
Cracked concrete temperature range II : 58°C / 35°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,09	0,11	0,13	0,15
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,38			
Cracked concrete temperature range III : 70°C / 43°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,18	0,22	0,25	0,29
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,54			

Table C8: Displacements under shear load

Hilti HIT-RE 100 with HZA-R			M12	M16	M20	M24
Displacement	δ_{V0}	[mm/kN]	0,05	0,04		0,03
	$\delta_{V\infty}$	[mm/kN]	0,08	0,06		0,05

Injection system Hilti HIT-RE 100

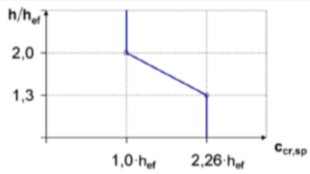
Performances
Displacements

Annex C6

Deutsches Institut für Bautechnik DIBt

Table C9: Characteristic values of resistance for rebar under tension loads in concrete

Hilti HIT-RE 100 with 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	γ_2 [2)] = γ_{inst} [3)]	[-]	1,4										
Steel failure													
Characteristic resistance for rebar B500B acc. to DIN 488:2009-08 [1)]	$N_{Rk,s}$	[kN]	28	43	62	85	111	173	270	292	339	388	442
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 non-cracked concrete C20/25													
Temperature range I: 40°C/24°C	$\tau_{Rk,ucr}$	[N/mm²]	14			12			11				
Temperature range II: 58°C/35°C	$\tau_{Rk,ucr}$	[N/mm²]	9			8			7				
Temperature range III: 70°C/43°C	$\tau_{Rk,ucr}$	[N/mm²]	5,5					5			4,5		
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5	$k_8 = k_{ucr}$ [3)]	[-]	10,1										
Characteristic bond resistance in cracked concrete C20/25													
Temperature range I: 40°C/24°C	$\tau_{Rk,cr}$	[N/mm²]	-	7		6,5		6		5,5			
Temperature range II: 58°C/35°C	$\tau_{Rk,cr}$	[N/mm²]	-	4,5			4			3,5			
Temperature range III: 70°C/43°C	$\tau_{Rk,cr}$	[N/mm²]	-	2,5				2,0					
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5	$k_8 = k_{cr}$ [3)]	[-]	7,2										
Increasing factor for τ_{Rk} in concrete	ψ_c	C30/37	1,00										
		C40/45	1,00										
		C50/60	1,00										
Splitting failure relevant for non-cracked 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)] The characteristic tension resistance $N_{Rk,s}$ for rebars that do not fulfil the requirements acc. DIN 488 shall be calculated acc. Technical Report TR 029, Equation (5.1).
[2)] Parameter for design according to EOTA Technical Report TR 029.
[3)] Parameter for design according to CEN/TS 1992-4:2009.

Injection system Hilti HIT-RE 100

Performances
Characteristic values of resistance under tension loads in concrete.
Design according to „EOTA Technical Report TR 029, 09/2010“or “CEN/TS 1992-4:2009”

Annex C7

Table C10: Characteristic values of resistance for rebar under shear loads in

HIT-RE 100 with 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													
Factor according to section 6.3.2.1 of CEN/TS 1992-4: 2009 part 5	k_2[4)]	[-]	1,0										
Characteristic resistance for rebar B500B acc. to DIN 488:2009-08 [1)]	$V_{Rk,s}$	[kN]	14	22	31	42	55	86	135	146	169	194	221
Steel failure with lever arm													
Characteristic resistance for rebar B500B acc. to DIN 488:2009-08 [2)]	$M^0_{Rk,s}$	[Nm]	33	65	112	178	265	518	1012	1139	1422	1749	2123
Concrete pry-out failure													
Factor acc. to equation (5.7) of TR 029 or acc. to equation (27) of CEN/TS 1992-4: 2009 part 5	k[3)] = k_3[4)]	[-]	2,0										

[1)] The characteristic shear resistance $V_{Rk,s}$ for rebars that do not fulfil the requirements acc. DIN 488 shall be calculated acc. Technical Report TR 029, Equation (5.5).
[2)] The characteristic bending resistance $M^0_{Rk,s}$ for rebars that do not fulfil the requirements acc. DIN 488 shall be calculated acc. Technical Report TR 029, Equation (5.6b).
[3)] Parameter for design according to EOTA Technical Report TR 029.
[4)] Parameter for design according to CEN/TS 1992-4:2009.

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Table C11: Displacements under tension load

<table>
<tr><th colspan="3">Hilti HIT-RE 100 with rebar</th><th>ϕ 8</th><th>ϕ 10</th><th>ϕ 12</th><th>ϕ 14</th><th>ϕ 16</th><th>ϕ 20</th><th>ϕ 25</th><th>ϕ 26</th><th>ϕ 28</th><th>ϕ 30</th><th>ϕ 32</th></tr>
<tr><td colspan="14">Non-cracked concrete temperature range I : 40°C / 24°C</td></tr>
<tr><td rowspan="2">Displacement</td><td>δ_{N0}</td><td>[mm/(N/mm²)]</td><td colspan="2">0,02</td><td colspan="2">0,03</td><td>0,04</td><td>0,05</td><td>0,06</td><td colspan="2">0,07</td><td colspan="2">0,08</td></tr>
<tr><td>$\delta_{N\infty}$</td><td>[mm/(N/mm²)]</td><td>0,04</td><td>0,05</td><td>0,06</td><td>0,07</td><td>0,08</td><td>0,11</td><td colspan="2">0,14</td><td>0,15</td><td>0,17</td><td>0,18</td></tr>
<tr><td colspan="14">Non-cracked concrete temperature range II : 58°C / 35°C</td></tr>
<tr><td rowspan="2">Displacement</td><td>δ_{N0}</td><td>[mm/(N/mm²)]</td><td>0,03</td><td>0,04</td><td>0,05</td><td>0,06</td><td>0,07</td><td>0,09</td><td colspan="2">0,12</td><td>0,13</td><td>0,14</td><td>0,15</td></tr>
<tr><td>$\delta_{N\infty}$</td><td>[mm/(N/mm²)]</td><td>0,07</td><td>0,09</td><td>0,10</td><td>0,12</td><td>0,14</td><td>0,18</td><td>0,23</td><td>0,24</td><td>0,26</td><td>0,28</td><td>0,30</td></tr>
<tr><td colspan="14">Non-cracked concrete temperature range III : 70°C / 43°C</td></tr>
<tr><td rowspan="2">Displacement</td><td>δ_{N0}</td><td>[mm/(N/mm²)]</td><td>0,07</td><td>0,09</td><td>0,10</td><td>0,12</td><td>0,14</td><td>0,18</td><td>0,23</td><td>0,24</td><td>0,26</td><td>0,28</td><td>0,30</td></tr>
<tr><td>$\delta_{N\infty}$</td><td>[mm/(N/mm²)]</td><td>0,09</td><td>0,12</td><td>0,15</td><td>0,17</td><td>0,20</td><td>0,26</td><td>0,33</td><td>0,34</td><td>0,37</td><td>0,40</td><td>0,43</td></tr>
<tr><td colspan="14">Cracked concrete temperature range I : 40°C / 24°C</td></tr>
<tr><td rowspan="2">Displacement</td><td>δ_{N0}</td><td>[mm/(N/mm²)]</td><td>-</td><td>0,04</td><td colspan="3">0,05</td><td>0,06</td><td colspan="2">0,07</td><td>0,08</td><td colspan="2">0,09</td></tr>
<tr><td>$\delta_{N\infty}$</td><td>[mm/(N/mm²)]</td><td>-</td><td colspan="10">0,23</td></tr>
<tr><td colspan="14">Cracked concrete temperature range II : 58°C / 35°C</td></tr>
<tr><td rowspan="2">Displacement</td><td>δ_{N0}</td><td>[mm/(N/mm²)]</td><td>-</td><td>0,08</td><td>0,09</td><td>0,10</td><td>0,11</td><td>0,13</td><td colspan="2">0,15</td><td>0,16</td><td colspan="2">0,17</td></tr>
<tr><td>$\delta_{N\infty}$</td><td>[mm/(N/mm²)]</td><td>-</td><td colspan="10">0,38</td></tr>
<tr><td colspan="14">Cracked concrete temperature range III : 70°C / 43°C</td></tr>
<tr><td rowspan="2">Displacement</td><td>δ_{N0}</td><td>[mm/(N/mm²)]</td><td>-</td><td>0,16</td><td>0,18</td><td>0,20</td><td>0,22</td><td>0,25</td><td>0,29</td><td>0,30</td><td>0,32</td><td>0,34</td><td>0,35</td></tr>
<tr><td>$\delta_{N\infty}$</td><td>[mm/(N/mm²)]</td><td>-</td><td colspan="10">0,54</td></tr>
</table>

Table C12: Displacements under shear load

<table>
<tr><th colspan="3">Hilti HIT-RE 100 with rebar</th><th>ϕ 8</th><th>ϕ 10</th><th>ϕ 12</th><th>ϕ 14</th><th>ϕ 16</th><th>ϕ 20</th><th>ϕ 25</th><th>ϕ 26</th><th>ϕ 28</th><th>ϕ 30</th><th>ϕ 32</th></tr>
<tr><td rowspan="2">Displacement</td><td>δ_{V0}</td><td>[mm/kN]</td><td>0,06</td><td colspan="2">0,05</td><td colspan="3">0,04</td><td colspan="5">0,03</td></tr>
<tr><td>$\delta_{V\infty}$</td><td>[mm/kN]</td><td>0,09</td><td>0,08</td><td>0,07</td><td colspan="2">0,06</td><td colspan="3">0,05</td><td colspan="3">0,04</td></tr>
</table>

Injection system Hilti HIT-RE 100

Performances
Displacements.

Annex C9