



## European Technical Assessment

**ETA-16/0143  
du 30/11/2016**

*English translation prepared by CSTB - Original version in French language*

### General Part

Nom commercial  
*Trade name*

**Injection system Hilti HIT-RE 500 V3**

Famille de produit  
*Product family*

Cheville à scellement avec tige filetée, fers à béton, douille taraudée et cheville de traction Hilti HZA pour ancrage dans le béton fissuré.

**Bonded fastener with threaded rods, rebar, internally sleeve and Hilti tension anchor HZA for use in concrete.**

Titulaire  
*Manufacturer*

Hilti Corporation  
Feldkircherstrasse 100  
FL-9494 Schaan  
Principality of Liechtenstein

Usine de fabrication  
*Manufacturing plants*

Hilti Plant

Cette évaluation contient:  
*This Assessment contains*

44 pages incluant 41 annexes qui font partie intégrante de cette évaluation  
*44 pages including 41 annexes which form an integral part of this assessment*

Base de l'ETE  
*Basis of ETA*

ETAG 001, Version April 2013, utilisée en tant que EAD  
*ETAG 001, Edition April 2013 used as EAD*

Cette évaluation remplace:  
*This Assessment replaces*

*ETE-16/0143 du 28/07/2016*  
*ETA-16/0143 dated 28/07/2016*

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## Specific Part

### 1 Technical description of the product

The Injection system Hilti HIT-RE 500 V3 is a bonded fastener consisting of a foil pack with injection mortar Hilti HIT-RE 500 V3 and a steel element.

- a threaded rod Hilti HIT-V, Hilti meter rod AM 8.8 or a commercial threaded rod with washer and hexagon nut in the range of M8 to M30
- a rebar in the range of  $\phi 8$  to  $\phi 32$
- a Hilti Tension Anchor HZA in the range of M12 to M27 or HZA-R in the range of M12 to M24.
- an internal threaded sleeve HIS-(R)N in the range M8 to M20

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 illustration and the description of the product are given in Annexes A.

### 2 Specification of the intended use

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

The provisions made in this European technical assessment are based on an assumed working life of the fastener of 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

#### 3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance for static and quasi static loads, Displacements	See Annex C1 to C16
Characteristic resistance for seismic performance category C1, Displacements	See Annex C17 to C20
Characteristic resistance for seismic performance category C2, Displacements	See Annex C21

#### 3.2 Safety in case of fire (BWR 2)

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

#### 3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances contained in this European technical approval, there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions).

### 3.4 Safety in use (BWR 4)

For Basic requirement Safety in use the same criteria are valid as for Basic Requirement Mechanical resistance and stability.

### 3.5 Protection against noise (BWR 5)

Not relevant.

### 3.6 Energy economy and heat retention (BWR 6)

Not relevant.

### 3.7 Sustainable use of natural resources (BWR 7)

For the sustainable use of natural resources no performance was determined for this product.

### 3.8 General aspects relating to fitness for use

Durability and Serviceability are only ensured if the specifications of intended use according to Annex B1 are kept.

## 4 Assessment and verification of constancy of performance (AVCP)

According to the Decision 96/582/EC of the European Commission<sup>1</sup>, as amended, the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table apply.

Product	Intended use	Level or class	System
Metal fasteners for use in concrete	For fixing and/or supporting to concrete, structural elements (which contributes to the stability of the works) or heavy units	—	1

## 5 Technical details necessary for the implementation of the AVCP system

Technical details necessary for the implementation of the Assessment and verification of constancy of performance (AVCP) system are laid down in the control plan deposited at Centre Scientifique et Technique du Bâtiment.

The manufacturer shall, on the basis of a contract, involve a notified body approved in the field of fasteners for issuing the certificate of conformity CE based on the control plan.

### The original French version is signed by

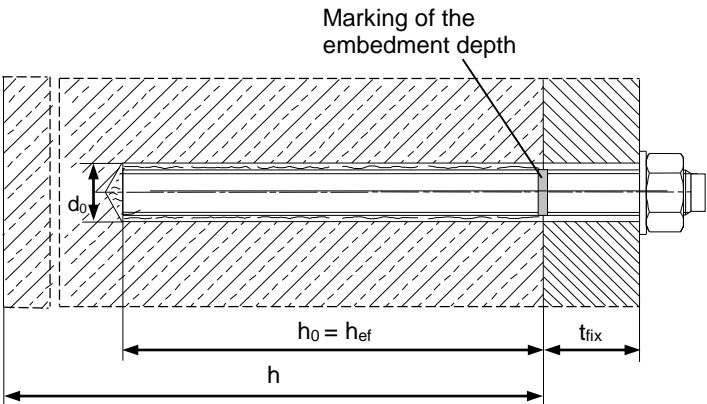
Charles Baloché  
Technical Director

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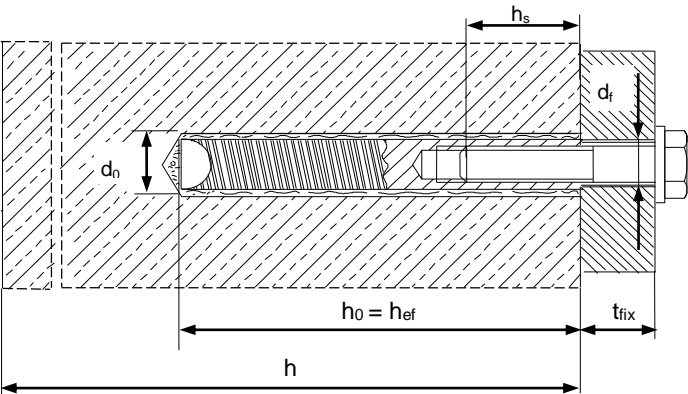
<sup>1</sup> Official Journal of the European Communities L 254 of 08.10.1996

Installed condition

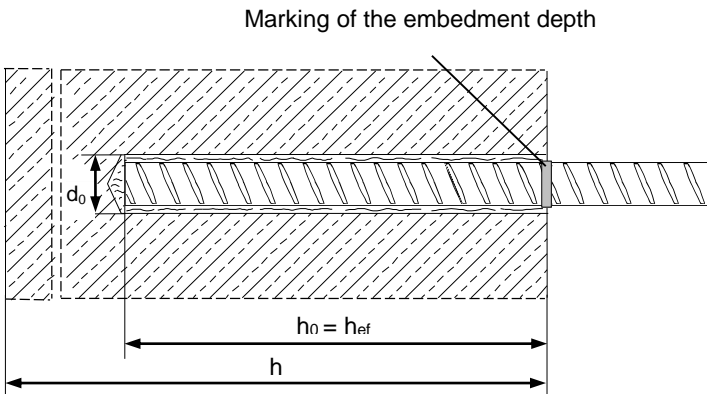
**Figure A1:**  
Threaded rod, HIT-V-..., AM...8.8 ...



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



**Figure A3:**  
Reinforcing bar (rebar)



Injection system Hilti HIT-RE 500 V3

**Product**  
Installed condition

**Annex A1**

## Product description: Injection mortar and steel elements

**Injection mortar Hilti HIT-RE 500 V3:** epoxy resin system with aggregate

330 ml, 500 ml and 1400 ml

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

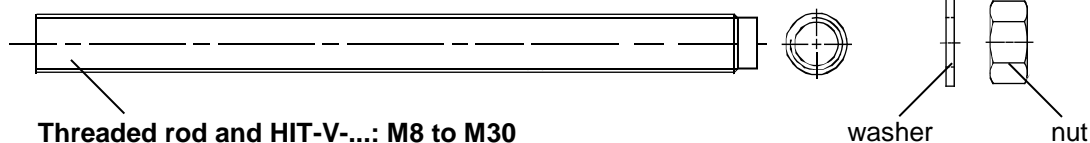


Product name: "Hilti HIT-RE 500 V3"

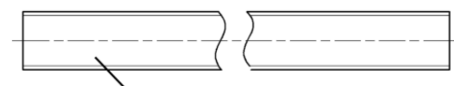
### Static mixer Hilti HIT-RE-M



### Steel elements



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



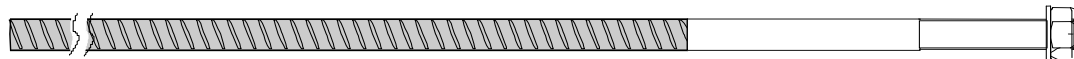
Hilti meter rod AM 8.8, electroplated zinc coated M8 to M30, 1m to 3m

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.



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



Hilti Tension Anchor HZA: M12 to M27 and HZA-R: M12 to M24



### Reinforcing bar (rebar): $\phi$ 8 to $\phi$ 32

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

Injection system Hilti HIT-RE 500 V3

#### Product

Injection mortar / Static mixer / Steel elements.

Annex A2

**Table A1: Materials**

Designation	Material
<b>Reinforcing bars (rebars)</b>	
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 $f_{uk} = f_{tk} = k \cdot f_{yk}$
<b>Metal parts made of zinc coated steel</b>	
Threaded rod, HIT-V-5.8(F)	Strength class 5.8, $f_{uk} = 500 \text{ N/mm}^2$ , $f_{yk} = 400 \text{ N/mm}^2$ Elongation at fracture ( $l_0 = 5d$ ) > 8% ductile Electroplated zinc coated $\geq 5 \mu\text{m}$ , (F) hot dip galvanized $\geq 45 \mu\text{m}$
Threaded rod, HIT-V-8.8(F)	Strength class 8.8, $f_{uk} = 800 \text{ N/mm}^2$ , $f_{yk} = 640 \text{ N/mm}^2$ Elongation at fracture ( $l_0 = 5d$ ) > 12% ductile Electroplated zinc coated $\geq 5 \mu\text{m}$ , (F) hot dip galvanized $\geq 45 \mu\text{m}$
Hilti Meter rod, AM 8.8	Strength class 8.8, $f_{uk} = 800 \text{ N/mm}^2$ , $f_{yk} = 640 \text{ N/mm}^2$ Elongation at fracture ( $l_0 = 5d$ ) > 12% ductile, Electroplated zinc coated $\geq 5 \mu\text{m}$
Hilti tension anchor HZA	Round steel with threaded part: electroplated zinc coated $\geq 5 \mu\text{m}$ Rebar: Bars class B according to NDP or NCL of EN 1992-1-1/NA:2013
Internally threaded sleeve HIS-N	Electroplated zinc coated $\geq 5 \mu\text{m}$
Washer	Electroplated zinc coated $\geq 5 \mu\text{m}$ , hot dip galvanized $\geq 45 \mu\text{m}$
Nut	Strength class of nut adapted to strength class of threaded rod. Electroplated zinc coated $\geq 5 \mu\text{m}$ , hot dip galvanized $\geq 45 \mu\text{m}$
<b>Metal parts made of stainless steel</b>	
Threaded rod, HIT-V-R	For $\leq \text{M24}$ : strength class 70, $f_{uk} = 700 \text{ N/mm}^2$ , $f_{yk} = 450 \text{ N/mm}^2$ For $> \text{M24}$ : strength class 50, $f_{uk} = 500 \text{ N/mm}^2$ , $f_{yk} = 210 \text{ N/mm}^2$ 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
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
<b>Metal parts made of high corrosion resistant steel</b>	
Threaded rod, HIT-V-HCR	For $\leq \text{M20}$ : $f_{uk} = 800 \text{ N/mm}^2$ , $f_{yk} = 640 \text{ N/mm}^2$ For $> \text{M20}$ : $f_{uk} = 700 \text{ N/mm}^2$ , $f_{yk} = 400 \text{ N/mm}^2$ , 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

**Injection system Hilti HIT-RE 500 V3**

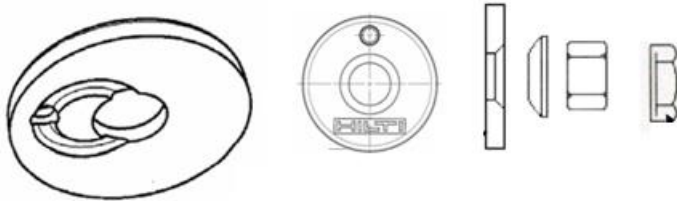
**Product description**  
Materials.

**Annex A2**

**Table A2: Materials of Hilti seismic filling set**

<b>metal part of zinc coated steel</b>	
Filling washer	Electroplated zinc coated $\geq 5 \mu\text{m}$
Spherical washer	Electroplated zinc coated $\geq 5 \mu\text{m}$
Lock nut	Electroplated zinc coated $\geq 5 \mu\text{m}$

**Hilti seismic filling set**



**Injection system Hilti HIT-RE 500 V3**

**Product description**  
 Materials.

**Annex A3**

## Specifications of intended use

### Anchorage subject to:

- Static and quasi static loading.
- Seismic performance category C1
- Seismic performance category C2 (only threaded rod HIT-V and AM grade 8.8 with hammer drilling and hammer drilling with Hilti hollow drill bit TE-CD, TE-YD).

### Base material:

- Reinforced or unreinforced normal weight concrete according to EN 206:2013.
- Strength classes C20/25 to C50/60 according to EN 206:2013.
- Cracked and non-cracked concrete.
- Flooded holes for non cracked concrete only

### 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 +70 °C  
(max. long term temperature +43 °C and max. short term temperature +70 °C)

### 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"  
"CEN/TS 1992-4:2009"
- Anchorages under seismic actions (cracked concrete) are designed in accordance with:  
"EOTA Technical Report TR 045, 02/2013"  
Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure. Fastenings in stand-off installation or with a grout layer under seismic action are not covered in this European technical assessment (ETA).

Injection system Hilti HIT-RE 500 V3

Intended use  
Specifications.

Annex B1



**Installation:**

- Use category:
  - dry or wet concrete (not in flooded holes): for all drilling techniques
  - dry or wet concrete or installation in flooded holes: for hammer drilling only, for non-cracked concrete only
- Drilling technique:
  - hammer drilling,
  - hammer drilling with Hilti hollow drill bit TE-CD, TE-YD,
  - diamond coring,
  - diamond coring with roughening with Hilti roughening tool TE-YRT.
- 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.

**Injection system Hilti HIT-RE 500 V3**

**Intended use**  
Specifications.

**Annex B2**

**Table B1: Installation parameters of threaded rod and HIT-V and AM**

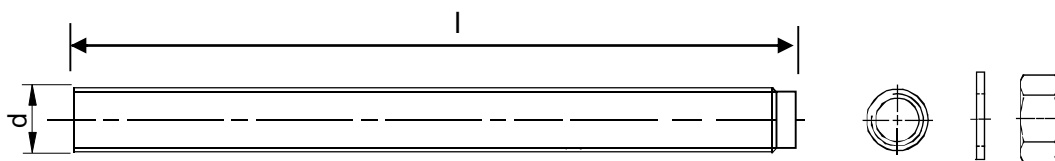
Threaded rod, HIT-V-..., AM...8.8	M8	M10	M12	M16	M20	M24	M27	M30
Diameter of element $d^{(1)} = d_{nom}^{(2)}$ [mm]	8	10	12	16	20	24	27	30
Nominal diameter of drill bit $d_0$ [mm]	10	12	14	18	22	28	30	35
Threaded rod, HIT-V-...: Effective embedment depth and drill hole depth $h_{ef} = h_0$ [mm]	60 to 160	60 to 200	70 to 240	80 to 320	90 to 400	96 to 480	108 to 540	120 to 600
Maximum diameter of clearance hole in the fixture $d_f$ [mm]	9	12	14	18	22	26	30	33
Minimum thickness of concrete member $h_{min}$ [mm]	$h_{ef} + 30$ $\geq 100$ 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	75	90	115	120	140
Minimum edge distance $c_{min}$ [mm]	40	45	45	50	55	60	75	80

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".

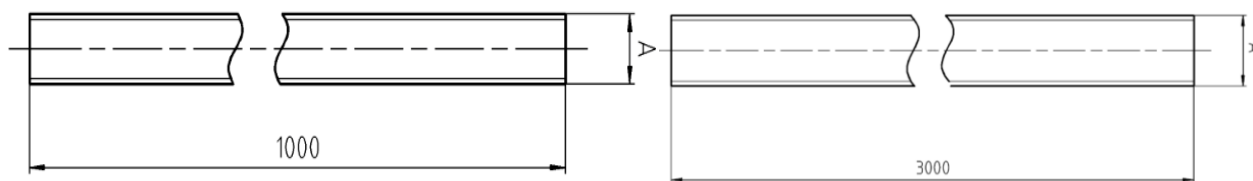
#### HIT-V-...



#### 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

#### AM...8.8



Injection system Hilti HIT-RE 500 V3

**Intended Use**  
Installation parameters.

**Annex B3**

**Table B2: Installation parameters of internally threaded sleeve HIS-(R)N**

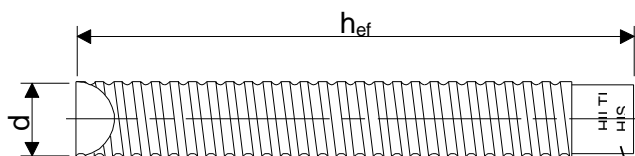
Internally threaded sleeve HIS-(R)N			M8	M10	M12	M16	M20
Outer diameter of sleeve	$d^{(1)} = d_{nom}^{(2)}$	[mm]	12,5	16,5	20,5	25,4	27,6
Nominal diameter of drill bit	$d_0$	[mm]	14	18	22	28	32
Effective embedment depth and drill hole depth	$h_{ef} = h_0$	[mm]	90	110	125	170	205
Maximum diameter of clearance hole in the fixture <sup>3)</sup>	$d_f$	[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 min-max	$h_s$	[mm]	8-20	10-25	12-30	16-40	20-50
Minimum spacing	$s_{min}$	[mm]	60	75	90	115	130
Minimum edge distance	$c_{min}$	[mm]	40	45	55	65	90

<sup>1)</sup> Parameter for design according to "EOTA Technical Report TR 029".

<sup>2)</sup> Parameter for design according to "CEN/TS 1992-4:2009".

<sup>3)</sup> For larger clearance hole see "TR 029 section 1.1".

#### 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 V3

**Intended Use**  
Installation parameters.

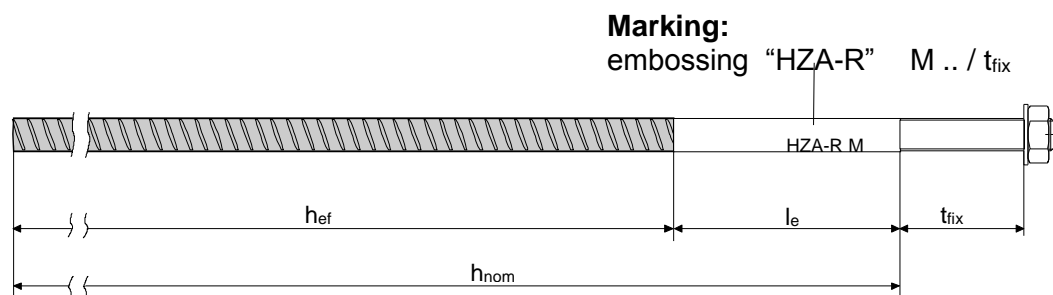
**Annex B4**

**Table B3: Installation parameters of Hilti tension anchor HZA-R**

Hilti tension anchor HZA-R			M12	M16	M20	M24
Rebar diameter	$\phi$	[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 <sup>1)</sup>	$d_f$	[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

<sup>1)</sup> For larger clearance hole see "TR 029 section 1.1".

### Hilti Tension Anchor HZA-R



Injection system Hilti HIT-RE 500 V3

**Intended Use**  
Installation parameters.

**Annex B5**

**Table B4: Installation parameters of Hilti tension anchor HZA**

Hilti tension anchor HZA			M12	M16	M20	M24	M27
Rebar diameter	$\phi$	[mm]	12	16	20	25	28
Nominal embedment depth and drill hole depth	$h_{nom} = h_0$	[mm]	90 to 240	100 to 320	110 to 400	120 to 500	140 to 560
Effective embedment depth ( $h_{ef} = h_{nom} - l_e$ )	$h_{ef}$	[mm]	$h_{nom} - 20$				
Length of smooth shaft	$l_e$	[mm]	20				
Nominal diameter of drill bit	$d_0$	[mm]	16	20	25	32	35
Maximum diameter of clearance hole in the fixture <sup>1)</sup>	$d_f$	[mm]	14	18	22	26	30
Maximum torque moment	$T_{max}$	[Nm]	40	80	150	200	270
Minimum thickness of concrete member	$h_{min}$	[mm]	$h_{nom} + 2 \cdot d_0$				
Minimum spacing	$s_{min}$	[mm]	65	80	100	130	140
Minimum edge distance	$c_{min}$	[mm]	45	50	55	60	75

<sup>1)</sup> For larger clearance hole see "TR 029 section 1.1".

Injection system Hilti HIT-RE 500 V3

Intended Use.  
Installation parameters.

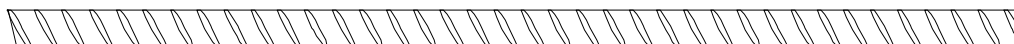
Annex B6

**Table B5: Installation parameters of reinforcing bar (rebar)**

Reinforcing bar (rebar)	$\phi$ 8	$\phi$ 10	$\phi$ 12	$\phi$ 14	$\phi$ 16	$\phi$ 20	$\phi$ 25	$\phi$ 28	$\phi$ 30	$\phi$ 32
Diameter $\phi$ [mm]	8	10	12	14	16	20	25	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	112 to 560	120 to 600	128 to 640
Nominal diameter of drill bit $d_0$ [mm]	10 <sup>1)</sup> 12 <sup>1)</sup>	12 <sup>1)</sup> 14 <sup>1)</sup>	14 <sup>1)</sup> 16 <sup>1)</sup>	18	20	25	30 <sup>1)</sup> 32 <sup>1)</sup>	35	37	40
Minimum thickness of concrete member $h_{min}$ [mm]	$h_{ef} + 30$ $\geq 100$ mm			$h_{ef} + 2 \cdot d_0$						
Minimum spacing $s_{min}$ [mm]	40	50	60	70	80	100	125	140	150	160
Minimum edge distance $c_{min}$ [mm]	40	45	45	50	50	65	70	75	80	80

<sup>1)</sup> 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  $0,05 \cdot \phi \leq h_{rib} \leq 0,07 \cdot \phi$   
( $\phi$ : Nominal diameter of the bar;  $h_{rib}$ : Rib height of the bar).

Injection system Hilti HIT-RE 500 V3

Intended Use.  
Installation parameters

Annex B7

**Table B6: Minimum curing time<sup>1)</sup>**

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

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











**Injection system Hilti HIT-RE 500 V3**

**Intended Use.**

Maximum working time and minimum curing time

**Annex B8**

**Table B7: Parameters of cleaning and setting tools**

Elements				Drill and clean				Installation	
Threaded rod, HIT-V-... AM...8.8	HIS-(R)N	Rebar	HZA(-R)	Hammer drilling	Hollow drill bit TE-CD, TE-YD	Diamond coring	Roughening tool TE-YRT	Brush	Piston plug
									
Size	Name	Size	Size	d <sub>0</sub> [mm]	d <sub>0</sub> [mm]	d <sub>0</sub> [mm]	d <sub>0</sub> [mm]	HIT-RB	HIT-SZ
M8	-	φ 8	-	10	-	10	-	10	-
M10	-	φ 8, φ 10	-	12	-	12	-	12	12
M12	M8	φ 10, φ 12	-	14	14	14	-	14	14
-	-	φ 12	M12	16	16	16	-	16	16
M16	M10	φ 14	-	18	18	18	18	18	18
-	-	φ 16	M16	20	20	20	20	20	20
M20	M12	-	-	22	22	22	22	22	22
-	-	φ 20	M20	25	25	25	25	25	25
M24	M16	-	-	28	28	28	28	28	28
M27	-	-	-	30	-	30	30	30	30
-	M20	φ 25	M24	32	32	32	32	32	32
M30	-	φ 28	M27	35	35	35	35	35	35
-	-	φ 30	-	37	-	37	-	37	37
-	-	φ 32	-	40	-	-	-	40	40
				-	-	42	-	42	42

### Cleaning alternatives

#### Compressed Air Cleaning (CAC):

air nozzle with an orifice opening of minimum 3,5 mm in diameter.



#### Automatic Cleaning (AC):

Cleaning is performed during drilling with Hilti TE-CD and TE-YD drilling system including vacuum cleaner.






Injection system Hilti HIT-RE 500 V3

**Intended use.**  
Cleaning and setting tools

**Annex B9**



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

Associated components				Installation															
Diamond coring		Roughening tool TE-YRT	Wear gauge RTG...	Minimum roughening time $t_{\text{roughen}}$															
																			
$d_0$ [mm]		$d_0$ [mm]	size	$t_{\text{roughen}} [\text{sec}] = h_{\text{ef}} [\text{mm}] / 10$															
nominal	measured																		
18	17,9 to 18,2	18	18	<table><tr><th><math>h_{\text{ef}} [\text{mm}]</math></th><th><math>t_{\text{roughen}} [\text{sec}]</math></th></tr><tr><td>0 to 100</td><td>10</td></tr><tr><td>101 to 200</td><td>20</td></tr><tr><td>201 to 300</td><td>30</td></tr><tr><td>301 to 400</td><td>40</td></tr><tr><td>401 to 500</td><td>50</td></tr><tr><td>501 to 600</td><td>60</td></tr></table>		$h_{\text{ef}} [\text{mm}]$	$t_{\text{roughen}} [\text{sec}]$	0 to 100	10	101 to 200	20	201 to 300	30	301 to 400	40	401 to 500	50	501 to 600	60
$h_{\text{ef}} [\text{mm}]$	$t_{\text{roughen}} [\text{sec}]$																		
0 to 100	10																		
101 to 200	20																		
201 to 300	30																		
301 to 400	40																		
401 to 500	50																		
501 to 600	60																		
20	19,9 to 20,2	20	20																
22	21,9 to 22,2	22	22																
25	24,9 to 25,2	25	25																
28	27,9 to 28,2	28	28																
30	29,9 to 30,2	30	30																
32	31,9 to 32,2	32	32																
35	34,9 to 35,2	35	35																

#### Hilti roughening tool TE-YRT and wear gauge RTG

TE-YRT	
RTG	

Injection system Hilti HIT-RE 500 V3

**Intended use.**

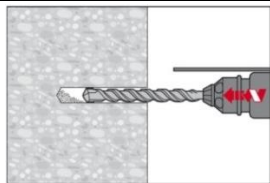
Parameters for use of the Hilti Roughening tool TE-YRT

**Annex B10**

## Installation instruction

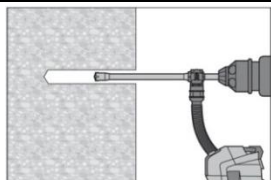
### Hole drilling

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



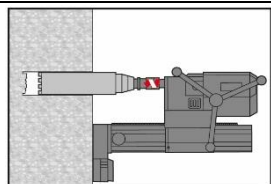
Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

**b) Hammer drilling with Hilti hollow drill bit TE-CD, TE-YD:** For dry and wet concrete only.



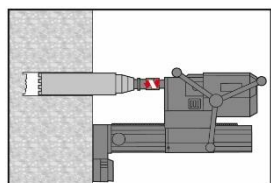
Drill hole to the required embedment depth with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit with Hilti vacuum attachment. This drilling system removes the dust and cleans the drill hole during drilling when used in accordance with the user's manual. After drilling is completed, proceed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

**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.

**d) Diamond coring with roughening with Hilti roughening tool TE-YRT:** For dry and wet concrete only.

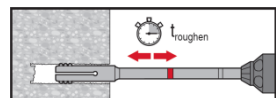


Diamond coring is permissible when suitable diamond core drilling machines and the corresponding core bits are used.

For the use in combination with Hilti roughening tool TE-YRT see parameters in Table B8.

Before roughening water needs to be removed from the borehole. Check usability of the roughening tool with the wear gauge RTG.

Roughen the borehole over the whole length to the required  $h_{ef}$ .



Injection system Hilti HIT-RE 500 V3

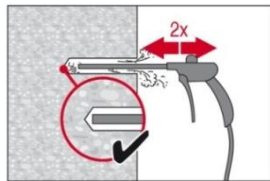
Intended use.  
Installation instructions

Annex B11

### Drill hole cleaning:

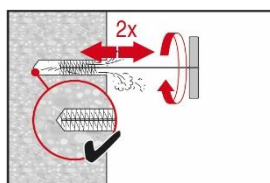
Just before setting an anchor, the drill hole must be free of dust and debris.  
Inadequate hole cleaning = poor load values.

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



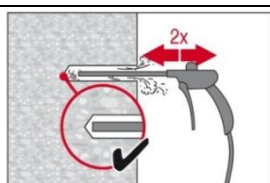
Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m<sup>3</sup>/h) until return air stream is free of noticeable dust.

For drill hole diameters  $\geq 32$  mm the compressor has to supply a minimum air flow of 140 m<sup>3</sup>/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  $\varnothing \geq$  drill hole  $\varnothing$ ) - if not the brush is too small and must be replaced with the proper brush diameter.



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

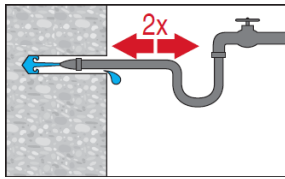
Injection system Hilti HIT-RE 500 V3

Intended use.  
Installation instructions

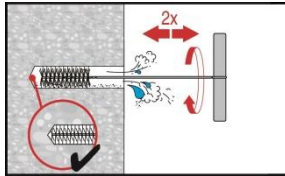
Annex B12

### Cleaning of hammer drilled flooded holes and diamond cored holes:

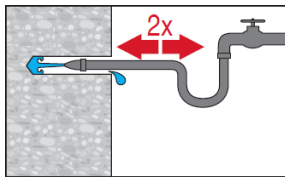
For all drill hole diameters  $d_0$  and all drill hole depths  $h_0$ .



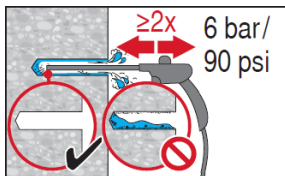
Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



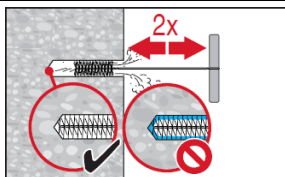
Brush 2 times with the specified brush (see Table B7) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.  
The brush must produce natural resistance as it enters the drill hole (brush  $\varnothing \geq$  drill hole  $\varnothing$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



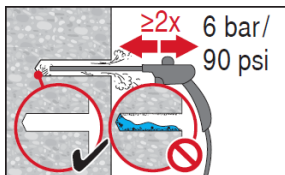
Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



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 m<sup>3</sup>/h) until return air stream is free of noticeable dust and water.  
For drill hole diameters  $\geq 32$  mm the compressor has to supply a minimum air flow of 140 m<sup>3</sup>/h.



Brush 2 times with the specified brush size (brush  $\varnothing \geq$  drill hole  $\varnothing$ , 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.

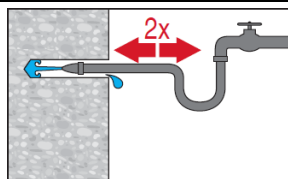
Injection system Hilti HIT-RE 500 V3

Intended use.  
Installation instructions

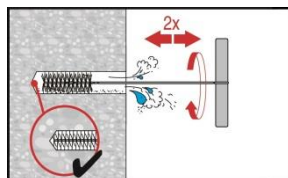
Annex B13

### Cleaning of diamond cored holes with roughening with Hilti roughening tool TE-YRT:

For all drill hole diameters  $d_0$  and all drill hole depths  $h_0$ .

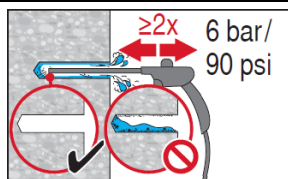


Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



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  $\varnothing \geq$  drill hole  $\varnothing$ ) - if not the brush is too small and must be replaced with the proper brush diameter.



Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m<sup>3</sup>/h) until return air stream is free of noticeable dust and water.

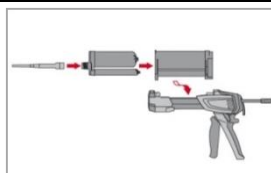
For drill hole diameters  $\geq 32$  mm the compressor has to supply a minimum air flow of 140 m<sup>3</sup>/h.

Injection system Hilti HIT-RE 500 V3

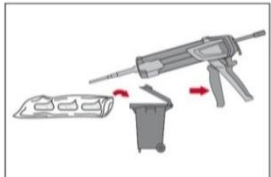
Intended use.  
Installation instructions

Annex B14

## Injection preparation

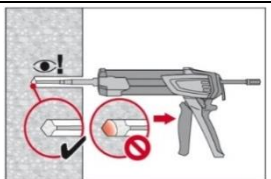


Tightly attach Hilti mixing nozzle HIT-RE-M to foil pack manifold. Do not modify the mixing nozzle.  
Observe the instruction for use of the dispenser.  
Check foil pack holder for proper function. Insert foil pack into foil pack holder and put holder into dispenser.

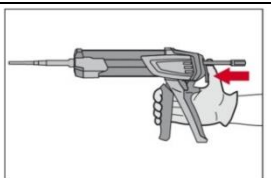


The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.  
Discarded quantities are:  
3 strokes for 330 ml foil pack,  
4 strokes for 500 ml foil pack,  
65 ml for 1400 ml foil pack.

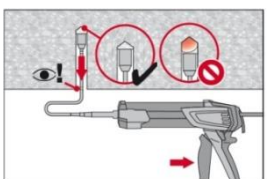
## Inject adhesive from the back of the drill hole without forming air voids.



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.



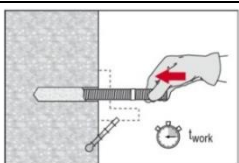
After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.



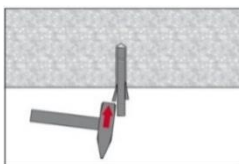
Overhead installation and/or installation with embedment depth  $h_{ef} > 250$  mm. For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug (see Table B7). Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure.

## Setting the element

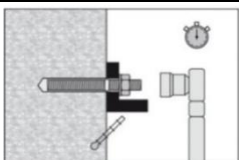
Just before setting an anchor, the drill hole must be free of dust and debris.



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.



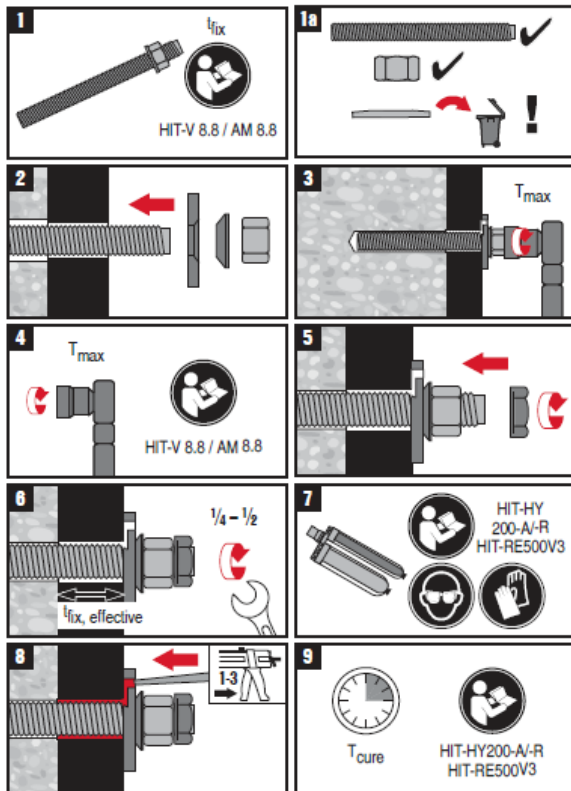
Loading the anchor: After required curing time  $t_{cure}$  (see Table B6) the anchor can be loaded.  
The applied installation torque shall not exceed the values  $T_{max}$  given in Tables B1, B2, B3 and B4.

Injection system Hilti HIT-RE 500 V3

Intended use.  
Installation instructions

Annex B15

## Installation with Seismic filling set (HIT-V and AM 8.8)



Injection system Hilti HIT-RE 500 V3

Intended use.  
Installation instructions

Annex B16

**Table C1: Characteristic resistance for threaded rods under tension load in concrete**

Threaded rod, HIT-V-..., AM...8.8				M8	M10	M12	M16	M20	M24	M27	M30
Installation safety factor											
Hammer drilling		$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,0							
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD		$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	-	1,0						
Diamond coring		$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,2			1,4				
Diamond coring with roughening with Hilti roughening tool TE-YRT		$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	-			1,0				
Hammer drilling in flooded holes		$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,4							
Steel failure threaded rods											
Characteristic resistance		$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$							
Partial safety factor Grade 5.8		$\gamma_{Ms,N}$	[-]	1,5							
Partial safety factor Grade 8.8		$\gamma_{Ms,N}$	[-]	1,5							
Partial safety factor HIT-V-R		$\gamma_{Ms,N}$	[-]	1,87						2,86	
Partial safety factor HIT-V-HCR		$\gamma_{Ms,N}$	[-]	1,5					2,1		
Combined pullout and concrete cone failure											
Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT											
Temperature range I: 40°C / 24°C		$\tau_{Rk,ucr}$	[N/mm²]	18	18	17	16	15	15	14	13
Temperature range II: 70°C / 43°C		$\tau_{Rk,ucr}$	[N/mm²]	14	13	13	12	12	11	10	10
Characteristic bond resistance in non-cracked concrete C20/25 in diamond cored holes.											
Temperature range I: 40°C / 24°C		$\tau_{Rk,ucr}$	[N/mm²]	12	12	12	12	12	11	11	11
Temperature range II: 70°C / 43°C		$\tau_{Rk,ucr}$	[N/mm²]	9,5	9	9	9	9	8,5	8,5	8,5
Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes and installation in water-filled holes											
Temperature range I: 40°C / 24°C		$\tau_{Rk,ucr}$	[N/mm²]	15	15	15	14	13	12	12	11
Temperature range II: 70°C / 43°C		$\tau_{Rk,ucr}$	[N/mm²]	12	11	11	10	10	9,5	9	8,5
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5		$k_8^{(2)}$	[-]	10,1							
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT											
Temperature range I: 40°C / 24°C		$\tau_{Rk,cr}$	[N/mm²]	6,5	7,5	8	8	8	8	8	8
Temperature range II: 70°C / 43°C		$\tau_{Rk,cr}$	[N/mm²]	5,5	6	6	6	6	6	6	6
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5		$k_8^{(2)}$	[-]	7,2							

**Injection system Hilti HIT-RE 500 V3**

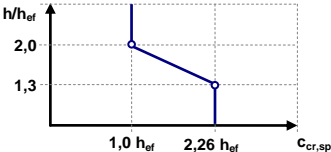
**Performances**

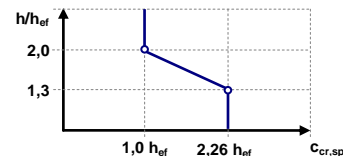
Characteristic resistance under tension load in concrete  
Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

**Annex C1**



Table C1: continued

Threaded rod, HIT-V-..., AM...8.8				M8	M10	M12	M16	M20	M24	M27	M30
Combined pullout and concrete cone failure (continued)											
Increasing factors for $\tau_{Rk}$ in concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes	$\psi_c$	C30/37	1,04							
			C40/50	1,07							
			C50/60	1,09							
	in diamond cored holes with roughening with Hilti roughening tool TE-YRT	$\psi_c$	C50/60	-		1,0					
Concrete cone failure											
Factor acc. to section 6.2.3 of CEN/TS 1992-4:2009 part 5		$k_{ucr}^{(2)}$	[-]	10,1							
		$k_{cr}^{(2)}$	[-]	7,2							
Edge distance		$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$							
Spacing		$s_{cr,N}$	[mm]	$3,0 \cdot h_{ef}$							
Splitting failure											
Factor acc. to section 6.2.3 of CEN/TS 1992-4:2009 part 5		$k_{ucr}^{(2)}$	[-]	10,1							
		$k_{cr}^{(2)}$	[-]	7,2							
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]	$2 \cdot c_{cr,sp}$							



<sup>1)</sup> Parameter for design according to EOTA Technical Report TR 029.

<sup>2)</sup> Parameter for design according to CEN/TS 1992-4:2009.

Injection system Hilti HIT-RE 500 V3

### Performances

Characteristic resistance under tension load in concrete

Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

Annex C2

**Table C2: Characteristic resistance for internally threaded sleeve HIS-(R)N under tension load in concrete**

HIS-(R)N			M8	M10	M12	M16	M20
Outer diameter of sleeve	$d^{(1)} = d_{nom}^{(2)}$	[mm]	12,5	16,5	20,5	25,4	27,6
Installation safety factor							
Hammer drilling	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,0				
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,0				
Diamond coring	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,2	1,4			
Diamond coring with roughening with Hilti roughening tool TE-YRT	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	-	1,0			
Hammer drilling in flooded holes	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,4				
Steel failure							
Characteristic resistance HIS-N with with screw grade 8.8	$N_{Rk,s}$	[kN]	25	46	67	125	116
Partial safety factor	$\gamma_{Ms,N}$	[-]	1,5				
Characteristic resistance HIS-RN with with screw grade 70	$N_{Rk,s}$	[kN]	26	41	59	110	166
Partial safety factor	$\gamma_{Ms,N}$	[-]	1,87				2,4
Combined pullout and concrete cone failure <sup>3)</sup>							
Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT							
Temperature range I: 40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	13	13	13	13	13
Temperature range II: 70°C / 43°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	10	10	10	10	10
Characteristic bond resistance in non-cracked concrete C20/25 in diamond cored holes.							
Temperature range I: 40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	8,5	8,5	9	9	9,5
Temperature range II: 70°C / 43°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	6,5	6,5	6,5	7	7
Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes and installation in water-filled holes							
Temperature range I: 40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	11	11	11	11	11
Temperature range II: 70°C / 43°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	8,5	8,5	8,5	8,5	8,5
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5	$k_8^{(3)}$	[-]	10,1				

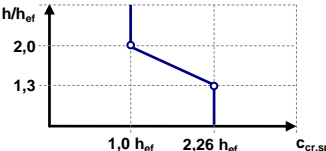
Injection system Hilti HIT-RE 500 V3

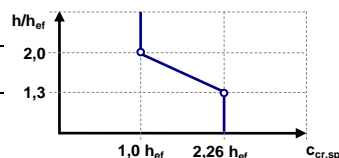
### Performances

Characteristic resistance under tension load in concrete  
Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

Annex C3

Table C2: continued

HIS-(R)N				M8	M10	M12	M16	M20
Combined pullout and concrete cone failure <sup>3)</sup> (continued)								
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT								
Temperature range I: 40°C / 24°C				$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	8,5	8,5	8,5
Temperature range II: 70°C / 43°C				$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	7	7	7
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5				$k_8^{2)}$	[-]	7,2		
Increasing factors for $\tau_{Rk}$ in concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes	$\psi_c$	C30/37	1,04				
			C40/50	1,07				
			C50/60	1,09				
		in diamond cored holes with roughening with Hilti roughening tool TE-YRT	$\psi_c$	C50/60	-	1,0		
Concrete cone failure								
Factor acc. to section 6.2.3 of CEN/TS 1992-4:2009 part 5				$k_{ucr}^{2)}$	[-]	10,1		
				$k_{cr}^{2)}$	[-]	7,2		
Edge distance				$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$		
Spacing				$s_{cr,N}$	[mm]	$3,0 \cdot h_{ef}$		
Splitting failure								
Factor acc. to section 6.2.3 of CEN/TS 1992-4:2009 part 5				$k_{ucr}^{2)}$	[-]	10,1		
				$k_{cr}^{2)}$	[-]	7,2		
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]	$2 \cdot c_{cr,sp}$		



<sup>1)</sup> Parameter for design according to EOTA Technical Report TR 029.

<sup>2)</sup> Parameter for design according to CEN/TS 1992-4:2009.

<sup>3)</sup> For design according to CEN/TS 1992-1:2009, the characteristic tension load values bond resistance may be calculated from the characteristic bond resistance for combined pull-out and concrete cone failure according to:  
 $N_{Rk} = \tau_{Rk} \cdot (h_{ef} \cdot d_1 \cdot \pi)$ .

Injection system Hilti HIT-RE 500 V3

### Performances

Characteristic resistance under tension load in concrete

Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

Annex C4

**Table C3: Characteristic resistance for Hilti tension anchor HZA / HZA-R under tension load in concrete**

HZA / HZA-R			M12	M16	M20	M24	M27
Rebar diameter	$\phi$	[mm]	12	16	20	25	28
Installation safety factor							
Hammer drilling	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,0				
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,0				
Diamond coring	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,2	1,4			
Diamond coring with roughening with Hilti roughening tool TE-YRT	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	-	1,0			
Hammer drilling in flooded holes	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,4				
Steel failure							
Characteristic resistance HZA	$N_{Rk,s}$	[kN]	46	86	135	194	252
Characteristic resistance HZA-R	$N_{Rk,s}$	[kN]	62	111	173	249	-
Partial safety factor	$\gamma_{Ms,N}$	[-]	1,4				
Combined pullout and concrete cone failure							
Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT							
Temperature range I: 40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	14	14	14	13	13
Temperature range II: 70°C / 43°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	11	10	10	10	9,5
Characteristic bond resistance in non-cracked concrete C20/25 in diamond cored holes.							
Temperature range I: 40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	9	9	9	9	9,5
Temperature range II: 70°C / 43°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	6,5	6,5	7	7	7
Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes and installation in water-filled holes							
Temperature range I: 40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	12	12	12	11	11
Temperature range II: 70°C / 43°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	9	9	8,5	8,5	8,5
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5	$k_8^{(3)}$	[-]	10,1				

**Injection system Hilti HIT-RE 500 V3**

**Performances**

Characteristic resistance under tension load in concrete  
Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

**Annex C5**

Table C3: continued

HZA / HZA-R				M12	M16	M20	M24	M27	
Rebar diameter		$\phi$	[mm]	12	16	20	25	28	
Combined pullout and concrete cone failure (continued)									
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT									
Temperature range I:		40°C / 24°C	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	9,5	9,5	10	10	11
Temperature range II:		70°C / 43°C	$\tau_{Rk,cr}$	[N/mm <sup>2</sup> ]	8	8	8	8	8
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5		$k_8^{2)}$	[-]		7,2				
Increasing factors for $\tau_{Rk}$ in concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes	$\psi_c$	C30/37	1,04					
			C40/50	1,07					
			C50/60	1,09					
	in diamond cored holes with roughening with Hilti roughening tool TE-YRT	$\psi_c$	C50/60	1,0					
Embedment depth for calculation of $N^0_{Rk,p}$ acc. eq. 5.2a (TR 029 §5.2.2.4 )		HZA	$h_{ef}$	[mm]	$h_{nom} -20$				
		HZA-R	$h_{ef}$	[mm]	$h_{nom} -100$			-	
Concrete cone failure									
Embedment depth for calculation of $N^0_{Rk,c}$ acc. eq. 5.3a (TR 029 §5.2.2.4 )		$h_{ef}$	[mm]	$h_{nom}$					
Factor acc. to section 6.2.3 of CEN/TS 1992-4:2009 part 5		$k_{ucr}^{2)}$	[-]		10,1				
		$k_{cr}^{2)}$	[-]		7,2				
Edge distance		$C_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$					
Spacing		$S_{cr,N}$	[mm]	$3,0 \cdot h_{ef}$					
Splitting failure									
Factor acc. to section 6.2.3 of CEN/TS 1992-4:2009 part 5		$k_{ucr}^{2)}$	[-]		10,1				
		$k_{cr}^{2)}$	[-]		7,2				
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) 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 500 V3

### Performances

Characteristic resistance under shear load in concrete

Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

Annex C6

**Table C4: Characteristic resistance for reinforcing bars (rebars) under tension load in concrete**

Reinforcing bar (rebar)					φ 8	φ 10	φ 12	φ 14	φ 16	φ 20	φ 25	φ 28	φ 30	φ 32
Installation safety factor														
Hammer drilling	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,0											
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	-	1,0									-	
Diamond coring	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,2						1,4					
Diamond coring with roughening with Hilti roughening tool TE-YRT	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	-	1,0								-		
Hammer drilling in flooded holes	$\gamma_2^{(1)} = \gamma_{inst}^{(2)}$	[-]	1,4											
Steel failure rebars														
Characteristic resistance for rebar B500B acc. to DIN 488:2009-08 <sup>1)</sup>	$N_{Rk,s}$	[kN]	28	43	62	85	111	173	270	339	388	442		
Partial safety factor for rebar B500B acc. to DIN 488:2009-08 <sup>1)</sup>	$\gamma_{Ms,N}$	[-]	1,4											
Combined pullout and concrete cone failure														
Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT														
Temperature range I: 40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	9,5	14	14	14	14	14	13	13	13	13		
Temperature range II: 70°C / 43°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	7	11	11	11	10	10	10	9,5	9,5	9,5		
Characteristic bond resistance in non-cracked concrete C20/25 in diamond cored holes.														
Temperature range I: 40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	9	9	9	9	9	9	9	9,5	9,5	9,5		
Temperature range II: 70°C / 43°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	6,5	6,5	6,5	6,5	6,5	7	7	7	7	7		
Characteristic bond resistance in non-cracked concrete C20/25 in hammer drilled holes and installation in water-filled holes														
Temperature range I: 40°C / 24°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	8	12	12	12	12	12	11	11	11	11		
Temperature range II: 70°C / 43°C	$\tau_{Rk,ucr}$	[N/mm <sup>2</sup> ]	5,5	9	9	9	9	8,5	8,5	8,5	8	8		
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5	$k_8$	[-]	10,1											

<sup>1)</sup> Values need to be calculated acc. EOTA Technical Report TR 029, Eq. 3.3a and Eq. 5.1, if rebars do not fulfil the requirements acc. DIN 488.

**Injection system Hilti HIT-RE 500 V3**

**Performances**

Characteristic resistance under shear load in concrete  
Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

**Annex C7**

Table C4: continued

Reinforcing bar (rebar)					φ 8	φ 10	φ 12	φ 14	φ 16	φ 20	φ 25	φ 28	φ 30	φ 32
Combined pullout and concrete cone failure (continued)														
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT														
Temperature range I: 40°C / 24°C		τ <sub>Rk,cr</sub>	[N/mm²]	4,5	8,5	9,5	9,5	9,5	10	10	11	11	11	11
Temperature range II: 70°C / 43°C		τ <sub>Rk,cr</sub>	[N/mm²]	4	7	8	8	8	8	8	8	8	8	8
Factor acc. to section 6.2.2.3 of CEN/TS 1992-4:2009 part 5			k <sub>s</sub> <sup>2)</sup>	[-]			7,2							
Increasing factors for τ <sub>Rk</sub> in concrete	in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD	ψ <sub>c</sub>	C30/37	1,04										
			C40/50	1,07										
	and diamond cored holes		C50/60	1,09										
	in diamond cored holes with roughening with Hilti roughening tool TE-YRT	ψ <sub>c</sub>	C50/60	1,0										
Concrete cone failure														
Combined pullout and concrete cone failure														
Factor acc. to section 6.2.3 of CEN/TS 1992-4:2009 part 5			k <sub>ucr</sub> <sup>2)</sup>	[-]			10,1							
			k <sub>cr</sub> <sup>2)</sup>	[-]			7,2							
Edge distance			c <sub>cr,N</sub>	[mm]			1,5 · h <sub>ef</sub>							
Spacing			s <sub>cr,N</sub>	[mm]			3,0 · h <sub>ef</sub>							
Splitting failure														
Factor acc. to section 6.2.3 of CEN/TS 1992-4:2009 part 5			k <sub>ucr</sub> <sup>2)</sup>	[-]			10,1							
			k <sub>cr</sub> <sup>2)</sup>	[-]			7,2							
Edge distance c <sub>cr,sp</sub> [mm] for			h / h <sub>ef</sub> ≥ 2,0		1,0 · h <sub>ef</sub>									
			2,0 > h / h <sub>ef</sub> > 1,3		4,6 · h <sub>ef</sub> - 1,8 · h									
			h / h <sub>ef</sub> ≤ 1,3		2,26 · h <sub>ef</sub>									
Spacing			s <sub>cr,sp</sub>	[mm]			2 · c <sub>cr,sp</sub>							

<sup>1)</sup> Parameter for design according to EOTA Technical Report TR 029.

<sup>2)</sup> Parameter for design according to CEN/TS 1992-4:2009.

Injection system Hilti HIT-RE 500 V3

### Performances

Characteristic resistance under tension load in concrete

Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

Annex C8

**Table C5: Characteristic resistance for threaded rods under shear load in concrete**

Threaded rod, HIT-V-..., AM...8.8			M8	M10	M12	M16	M20	M24	M27	M30
Partial safety factor										
Steel failure grade 5.8	$\gamma_{Ms,v}$	[-]	1,25							
Steel failure grade 8.8	$\gamma_{Ms,v}$	[-]	1,25							
Steel failure HIT-V-R	$\gamma_{Ms,v}$	[-]	1,56						2,38	
Steel failure HIT-V-HCR	$\gamma_{Ms,v}$	[-]	1,25					1,75		
Steel failure without lever arm for threaded rod, HIT-V										
Factor according to section 6.3.2.1 of CEN/TS 1992-4 :2009 part 5	$k_2^{(2)}$	[-]	1,0							
Characteristic resistance	$V_{Rk,s}$	[kN]	$0,5 \cdot A_s \cdot f_{uk}$							
Steel failure with lever arm for threaded rod, HIT-V										
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$							
Concrete pry-out failure										
Factor in 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							
Concrete edge failure										
See section 5.2.3.4 of TR 029 « Design of bonded anchors »										

<sup>1)</sup> Parameter for design according to "EOTA Technical Report TR 029".

<sup>2)</sup> Parameter for design according to CEN/TS 1992-4:2009.

**Injection system Hilti HIT-RE 500 V3**

**Performances**

Characteristic resistance under shear load in concrete

Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

**Annex C9**



**Table C6: Characteristic resistance for for internally threaded sleeve HIS-(R)N under shear load in concrete**

HIS-(R)N		M8	M10	M12	M16	M20		
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 resistance HIS-N screw class 8.8	$V_{Rk,s}$	[kN]	13	23	34	63	58	
Partial safety factor	$\gamma_{Ms,v}$	[-]					1,25	
Characteristic resistance HIS-RN screw class 70	$V_{Rk,s}$	[kN]	13	20	30	55	83	
Partial safety factor	$\gamma_{Ms,v}$	[-]					1,56	2,0
Steel failure with lever arm								
Characteristic resistance HIS-N screw class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	
Partial safety factor	$\gamma_{Ms,v}$	[-]					1,25	
Characteristic resistance HIS-RN screw class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454	
Partial safety factor	$\gamma_{Ms,v}$	[-]					1,56	
Concrete pryout failure								
Factor in 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	
Concrete edge failure see TR 029								
See section 5.2.3.4 of TR 029 « Design of bonded anchors »								

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 500 V3**

**Performances**

Characteristic resistance under shear load in concrete

Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

**Annex C10**

**Table C7: Characteristic resistance for Hilti tension anchor HZA / HZA-R under shear load in concrete**

HZA / HZA-R			M12	M16	M20	M24	M27
Rebar diameter	$\phi$	[mm]	12	16	20	25	28
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 resistance HZA	$V_{Rk,s}$	[kN]	23	43	67	97	126
Characteristic resistance HZA-R	$V_{Rk,s}$	[kN]	31	55	86	124	-
Partial safety factor	$\gamma_{Ms,v}$	[-]	1,5				
Steel failure with lever arm							
Characteristic resistance HZA	$M^0_{Rk,s}$	[Nm]	72	183	357	617	915
Characteristic resistance HZA-R	$M^0_{Rk,s}$	[Nm]	97	234	458	790	-
Partial safety factor	$\gamma_{Ms,v}$	[-]	1,5				
Concrete pryout failure							
Factor in 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				
Concrete edge failure see TR 029							
See section 5.2.3.4 of TR 029 « Design of bonded anchors »							

<sup>1)</sup> Parameter for design according to "EOTA Technical Report TR 029".

<sup>2)</sup> Parameter for design according to CEN/TS 1992-4:2009.

Injection system Hilti HIT-RE 500 V3

### Performances

Characteristic resistance under shear load in concrete

Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

Annex C11

**Table C8: Characteristic resistance for reinforcing bars (rebars) under shear load in concrete**

Reinforcing bar (rebar)	ϕ 8	ϕ 10	ϕ 12	ϕ 14	ϕ 16	ϕ 20	ϕ 25	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	$k_2^{2)}$	[-]									1,0	
Characteristic resistance for rebar B500B acc. to DIN 488:2009-08 <sup>3)</sup>	$V_{Rk,s}$	[kN]	14	22	31	42	55	86	135	169	194	221
Partial safety factor for rebar B500B acc. to DIN 488:2009-08 <sup>3)</sup>	$\gamma_{Ms,v}$	[-]									1,5	
Steel failure with lever arm												
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	33	65	112	178	265	518	1012	1422	1749	2123
Partial safety factor	$\gamma_{Ms,v}$	[-]									1,5	
Concrete pryout failure												
Factor in 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	
Concrete edge failure see TR 029												
See section 5.2.3.4 of TR 029 « Design of bonded anchors »												

<sup>1)</sup> Parameter for design according to "EOTA Technical Report TR 029".

<sup>2)</sup> Parameter for design according to CEN/TS 1992-4:2009.

<sup>3)</sup> Values need to be calculated acc. EOTA Technical Report TR 029, Eq. 3.3b, Eq. 3.3c, Eq. 5.5 and Eq. 5.6b, if rebars do not fulfil the requirements acc. DIN 488.

**Injection system Hilti HIT-RE 500 V3**

**Performances**

Characteristic resistance under shear load in concrete

Design according to "EOTA Technical Report TR 029, 09/2010" or "CEN/TS 1992-4:2009"

**Annex C12**

**Table C9: Displacements for threaded rod under tension load**

Threaded rod, HIT-V-..., AM...8.8			M8	M10	M12	M16	M20	M24	M27	M30
<b>Non-cracked concrete</b>										
Temperature range I: 40°C / 24°C										
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0,04	0,05	0,05	0,06	0,06	0,07	0,08	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0,10	0,11	0,12	0,13	0,15	0,17	0,18	0,19
Temperature range II: 70°C / 43°C										
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0,05	0,05	0,06	0,07	0,07	0,08	0,09	0,10
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0,12	0,13	0,14	0,16	0,18	0,20	0,21	0,23
<b>Cracked concrete</b>										
Temperature range I: 40°C / 24°C										
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0,02	0,03	0,05	0,08	0,10	0,13	0,15	0,18
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0,12	0,19	0,14	0,19	0,16	0,16	0,15	0,18
Temperature range II: 70°C / 43°C										
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0,02	0,04	0,06	0,09	0,12	0,16	0,18	0,21
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0,15	0,23	0,17	0,23	0,19	0,19	0,18	0,21

**Table C10: Displacements for threaded rod under shear load**

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

Injection system Hilti HIT-RE 500 V3

**Performances**  
Displacements

**Annex C13**

**Table C11: Displacements for HIS-N under tension load**

HIS-(R)N			M8	M10	M12	M16	M20
Non-cracked concrete							
Temperature range I: 40°C / 24°C							
Displacement	$\delta_{N0}$	[mm/(N/mm²)]	0,05	0,06	0,06	0,07	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,15	0,17	0,18
Temperature range II: 70°C / 43°C							
Displacement	$\delta_{N0}$	[mm/(N/mm²)]	0,06	0,07	0,07	0,08	0,09
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,14	0,16	0,18	0,20	0,21
Cracked concrete							
Temperature range I: 40°C / 24°C							
Displacement	$\delta_{N0}$	[mm/(N/mm²)]	0,05	0,08	0,10	0,13	0,15
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,14	0,19	0,16	0,16	0,15
Temperature range II: 70°C / 43°C							
Displacement	$\delta_{N0}$	[mm/(N/mm²)]	0,06	0,09	0,12	0,16	0,18
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,17	0,23	0,19	0,19	0,18

**Table C12: Displacements for HIS-N under shear load**

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

Injection system Hilti HIT-RE 500 V3

**Performances**  
Displacements

**Annex C14**

**Table C13: Displacements for Hilti tension anchor HZA / HZA-R under tension load**

HZA / HZA-R			M12	M16	M20	M24	M27
Non-cracked concrete							
Temperature range I: 40°C / 24°C							
Displacement	$\delta_{N0}$	[mm/(N/mm²)]	0,05	0,06	0,06	0,07	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,15	0,17	0,18
Temperature range II: 70°C / 43°C							
Displacement	$\delta_{N0}$	[mm/(N/mm²)]	0,06	0,07	0,07	0,08	0,09
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,14	0,16	0,18	0,20	0,21
Cracked concrete							
Temperature range I: 40°C / 24°C							
Displacement	$\delta_{N0}$	[mm/(N/mm²)]	0,05	0,08	0,10	0,13	0,15
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,14	0,19	0,16	0,16	0,15
Temperature range II: 70°C / 43°C							
Displacement	$\delta_{N0}$	[mm/(N/mm²)]	0,06	0,09	0,12	0,16	0,18
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,17	0,23	0,19	0,19	0,18

**Table C14: Displacements for Hilti tension anchor HZA / HZA-R under shear load**

HZA / HZA-R			M12	M16	M20	M24	M27
Displacement	$\delta_{V0}$	[mm/kN]	0,05	0,04	0,04	0,03	0,03
Displacement	$\delta_{V\infty}$	[mm/kN]	0,08	0,06	0,06	0,05	0,05

Injection system Hilti HIT-RE 500 V3

**Performances**  
Displacements

**Annex C15**

**Table C15: Displacements for rebar under tension load**

Reinforcing bar (rebar)		φ 8	φ 10	φ 12	φ 14	φ 16	φ 20	φ 25	φ 28	φ 30	φ 32
<b>Non-cracked concrete</b>											
Temperature range I: 40°C / 24°C											
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0,05	0,05	0,05	0,06	0,06	0,07	0,07	0,08	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0,11	0,11	0,00	0,13	0,15	0,17	0,18	0,19	0,20
Temperature range II: 70°C / 43°C											
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0,05	0,05	0,06	0,07	0,07	0,09	0,09	0,09	0,10
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0,13	0,13	0,00	0,16	0,18	0,20	0,21	0,22	0,24
<b>Cracked concrete</b>											
Temperature range I: 40°C / 24°C											
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0,03	0,03	0,06	0,08	0,10	0,14	0,15	0,16	0,18
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0,19	0,19	0,06	0,19	0,16	0,16	0,15	0,16	0,18
Temperature range II: 70°C / 43°C											
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0,04	0,04	0,07	0,09	0,12	0,17	0,17	0,19	0,21
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0,23	0,23	0,07	0,23	0,19	0,19	0,18	0,19	0,21

**Table C16: Displacements for rebar under shear load**

Reinforcing bar (rebar)		φ 8	φ 10	φ 12	φ 14	φ 16	φ 20	φ 25	φ 28	φ 30	φ 32
Displacement	$\delta_{V0}$	[mm/kN]	0,05	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03
Displacement	$\delta_{V\infty}$	[mm/kN]	0,08	0,08	0,07	0,06	0,06	0,05	0,05	0,05	0,04

Injection system Hilti HIT-RE 500 V3

**Performances**  
Displacements

**Annex C16**

**Seismic design shall be carried out according TR 045 “Design of Metal Anchors Under Seismic Action”**

**Table C17: Characteristic resistance for threaded rods under tension loads for seismic category C1 in concrete**

Threaded rod, HIT-V-..., AM...8.8	M8	M10	M12	M16	M20	M24	M27	M30
Steel failure threaded rods								
Characteristic resistance NRk,s,seis [kN]	As · fuk							
Combined pullout and concrete cone failure								
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT								
Temperature range I: 40°C / 24°C τRk,seis [N/mm²]	6,0	7,0	7,9	7,9	8,0	8,2	8,3	8,1
Temperature range II: 70°C / 43°C τRk,seis [N/mm²]	4,8	5,7	6,4	6,4	6,5	6,6	6,4	6,1

**Table C18: Characteristic resistance for threaded rods under shear loads for seismic category C1 in concrete**

Threaded rod, HIT-V-..., AM...8.8	M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm								
Characteristic resistance HIT-V, AM...8.8 $V_{Rk,s,seis}$ [kN]	$0,5 \cdot A_s \cdot f_{uk}$							
Characteristic resistance Commercial standard threaded rod $V_{Rk,s,seis}$ [kN]	$0,35 \cdot A_s \cdot f_{uk}$							

**Table C19: Displacement for threaded rods under tension loads for seismic category C1 in concrete**

Threaded rod, HIT-V-..., AM...8.8	M8	M10	M12	M16	M20	M24	M27	M30
Displacement <sup>1)</sup> $\delta_{N,seis}$ [mm]	2,7	3,0	3,3	3,9	4,5	5,1	5,6	6,0

<sup>1)</sup> Maximum displacement during cycling (seismic event).

**Table C20: Displacement for threaded rods under shear loads for seismic category C1 in concrete**

Threaded rod, HIT-V-..., AM...8.8	M8	M10	M12	M16	M20	M24	M27	M30
Displacement <sup>1)</sup> $\delta_{V,seis}$ [mm]	3,2	3,5	3,8	4,4	5,0	5,6	6,1	6,5

<sup>1)</sup> Maximum displacement during cycling (seismic event).

**Injection system Hilti HIT-RE 500 V3**

### Performances

Characteristic values for seismic performance category C1 and displacements  
Design according to “EOTA Technical Report TR 045, 02/2013”

**Annex C17**



**Table C21: Characteristic resistance for internally threaded sleeve HIS-(R)N under tension load for seismic category C1 in concrete**

HIS-(R)N			M8	M10	M12	M16	M20	
Steel failure								
Characteristic resistance HIS-N with with screw grade 8.8	$N_{Rk,s,seis}$	[kN]	25	46	67	125	116	
Characteristic resistance HIS-RN with with screw grade 70	$N_{Rk,s,seis}$	[kN]	26	41	59	110	166	
Partial safety factor HIS-N with with screw grade 8.8	$\gamma_{Ms,N,seis}$	[-]	1,5					
Partial safety factor HIS-RN with with screw grade 70	$\gamma_{Ms,N,seis}$	[-]	1,87					2,4
Combined pullout and concrete cone failure								
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT								
Temperature range I: 40°C / 24°C	$\tau_{Rk,seis}$	[N/mm²]	8,0	8,0	8,0	8,5	8,5	
Temperature range II: 70°C / 43°C	$\tau_{Rk,seis}$	[N/mm²]	6,5	6,5	6,5	7,0	7,0	

**Table C22: Characteristic resistance for internally threaded sleeve HIS-(R)N under shear load for seismic category C1 in concrete**

HIS-(R)N		M8	M10	M12	M16	M20
<b>Steel failure without lever arm</b>						
Characteristic resistance HIS-N with with screw grade 8.8	$V_{Rk,s,seis}$ [kN]	9	16	27	41	39
Characteristic resistance HIS-RN with with screw grade 70	$V_{Rk,s,seis}$ [kN]	9	14	21	39	58

**Table C23: Displacement for internally threaded sleeve HIS-(R)N under tension loads for seismic category C1 in concrete**

HIS-(R)N		M8	M10	M12	M16	M20
Displacement <sup>1)</sup>	$\delta_{N,seis}$ [mm]	3,4	4,0	4,6	5,3	5,6

<sup>1)</sup> Maximum displacement during cycling (seismic event).

**Table C24: Displacement for internally threaded sleeve HIS-(R)N under shear loads for seismic category C1 in concrete**

HIS-(R)N		M8	M10	M12	M16	M20
Displacement <sup>1)</sup>	$\delta_{V,seis}$ [mm]	3,9	4,5	5,1	5,8	6,1

<sup>1)</sup> Maximum displacement during cycling (seismic event).

**Injection system Hilti HIT-RE 500 V3**

### Performances

Characteristic values for seismic performance category C1 and displacements  
Design according to "EOTA Technical Report TR 045, 02/2013"

**Annex C18**

**Table C25: Characteristic resistance for Hilti tension anchor HZA / HZA-R under tension load for seismic category C1 in concrete**

HZA / HZA-R			M12	M16	M20	M24	M27
Steel failure							
Characteristic resistance HZA	N <sub>Rk,s,seis</sub>	[kN]	46	86	135	194	252
Characteristic resistance HZA-R	N <sub>Rk,s,seis</sub>	[kN]	62	111	173	249	-
Partial safety factor	γ <sub>Ms,N,seis</sub>	[-]	1,4				
Combined pullout and concrete cone failure							
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT							
Temperature range I: 40°C / 24°C	τ <sub>Rk,seis</sub>	[N/mm²]	9,0	9,5	9,5	10,0	11,0
Temperature range II: 70°C / 43°C	τ <sub>Rk,seis</sub>	[N/mm²]	7,5	7,5	8,0	8,0	8,0

**Table C26: Characteristic resistance for Hilti tension anchor HZA / HZA-R under shear load for seismic category C1 in concrete**

HZA / HZA-R		M12	M16	M20	M24	M27
<b>Steel failure without lever arm</b>						
Characteristic resistance HZA	$V_{Rk,s,seis}$ [kN]	23	43	67	97	126
Characteristic resistance HZA-R	$V_{Rk,s,seis}$ [kN]	31	55	86	124	-

**Table C27: Displacement for Hilti tension anchor HZA / HZA-R under tension loads for seismic category C1 in concrete**

HZA / HZA-R		M12	M16	M20	M24	M27
Displacement <sup>1)</sup>	$\delta_{N,seis}$ [mm]	3,3	3,9	4,5	5,3	5,7

<sup>1)</sup> Maximum displacement during cycling (seismic event).

**Table C28: Displacement for Hilti tension anchor HZA / HZA-R under shear loads for seismic category C1 in concrete**

HZA / HZA-R		M12	M16	M20	M24	M27
Displacement <sup>1)</sup>	$\delta_{V,seis}$ [mm]	3,8	4,4	5,0	5,8	6,2

<sup>1)</sup> Maximum displacement during cycling (seismic event).

Injection system Hilti HIT-RE 500 V3

### Performances

Characteristic values for seismic performance category C1 and displacements  
Design according to "EOTA Technical Report TR 045, 02/2013"

Annex C19

**Table C29: Characteristic resistance for reinforcing bars (rebars) under tension load for seismic category C1 in concrete**

Reinforcing bar (rebar)	φ 8	φ 10	φ 12	φ 14	φ 16	φ 20	φ 25	φ 28	φ 30	φ 32
<b>Steel failure rebars</b>										
Characteristic resistance for rebar B500B acc. to DIN 488:2009-08 <sup>1)</sup> $N_{Rk,seis}$ [kN]	-	43	62	85	111	173	270	339	388	442
<b>Combined pullout and concrete cone failure</b>										
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD and diamond cored holes with roughening with Hilti roughening tool TE-YRT										
Temperature range I: 40°C / 24°C $\tau_{Rk,seis}$ [N/mm <sup>2</sup> ]	-	8,0	9,0	9,0	9,5	9,5	10,0	11,0	11,0	11,0
Temperature range II: 70°C / 43°C $\tau_{Rk,seis}$ [N/mm <sup>2</sup> ]	-	6,5	7,5	7,0	7,5	8,0	8,0	8,0	8,0	8,0

<sup>1)</sup> Values need to be calculated acc. EOTA Technical Report TR 029, Eq. 5.1, if rebars do not fulfil the requirements acc. DIN 488.

**Table C30: Characteristic resistance for reinforcing bars (rebars) under shear loads for seismic category C1 in concrete**

Reinforcing bar (rebar)	φ 8	φ 10	φ 12	φ 14	φ 16	φ 20	φ 25	φ 28	φ 30	φ 32
<b>Steel failure without lever arm</b>										
Characteristic resistance for rebar B500B acc. to DIN 488:2009-08 <sup>1)</sup> $V_{Rk,seis}$ [kN]	-	15	22	29	39	60	95	118	135	155

<sup>1)</sup> Values need to be calculated acc. EOTA Technical Report TR 029, Eq. 5.5 with  $V_{Rk,seis} = 0,7 \cdot V_{Rk,s}$ , if rebars do not fulfil the requirements acc. DIN 488.

**Table C31: Displacement for reinforcing bars (rebars) under tension loads for seismic category C1 in concrete**

Reinforcing bar (rebar)	φ 8	φ 10	φ 12	φ 14	φ 16	φ 20	φ 25	φ 28	φ 30	φ 32
Displacement <sup>1)</sup> $\delta_{N,seis}$ [mm]	-	3,0	3,3	3,6	3,9	4,5	5,3	5,7	6,0	6,3

<sup>1)</sup> Maximum displacement during cycling (seismic event).

**Table C32: Displacement for reinforcing bars (rebars) under shear loads for seismic category C1 in concrete**

Reinforcing bar (rebar)	φ 8	φ 10	φ 12	φ 14	φ 16	φ 20	φ 25	φ 28	φ 30	φ 32
Displacement <sup>1)</sup> $\delta_{V,seis}$ [mm]	-	3,5	3,8	4,1	4,4	5,0	5,8	6,2	6,5	6,8

<sup>1)</sup> Maximum displacement during cycling (seismic event).

Injection system Hilti HIT-RE 500 V3

### Performances

Characteristic values for seismic performance category C1 and displacements  
Design according to "EOTA Technical Report TR 045, 02/2013"

Annex C20

**Table C33: Characteristic resistance for threaded rod under tension load for seismic category C2 in concrete**

Threaded rod, HIT-V-..., AM...8.8	M8	M10	M12	M16	M20	M24	M27	M30
Steel failure threaded rods								
Characteristic resistance N <sub>Rk,s,seis</sub> [kN]	A <sub>s</sub> · f <sub>uk</sub>							
Combined pullout and concrete cone failure								
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes and hammer drilled holes with Hilti hollow drill bit TE-CD or TE-YD								
Temperature range I: 40°C / 24°C τ <sub>Rk,seis</sub> [N/mm²]	-	-	-	5,5	5,4	5,1	-	-
Temperature range II: 70°C / 43°C τ <sub>Rk,seis</sub> [N/mm²]	-	-	-	4,1	4,1	3,9	-	-

**Table C34: Characteristic resistance for threaded rods under shear loads for seismic category C2 in concrete**

Threaded rod, HIT-V-..., AM...8.8	M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm, using Hilti seismic filling set								
Characteristic resistance HIT-V 8.8 / AM 8.8 $V_{Rk,s,seis}$ [kN]	-	-	-	46	77	103	-	-
Steel failure without lever arm, without using Hilti seismic filling set								
Characteristic resistance HIT-V 8.8 / AM 8.8 $V_{Rk,s,seis}$ [kN]	-	-	-	40	71	90	-	-
Characteristic resistance Commercial standard threaded rod $V_{Rk,s,seis}$ [kN]	-	-	-	28	50	63	-	-

**Table C35: Displacement for threaded rods under tension loads for seismic category C2 in concrete**

Threaded rod, HIT-V-..., AM...8.8	M8	M10	M12	M16	M20	M24	M27	M30
Displacement DLS $\delta_{N,seis}(DLS)$ [mm]	-	-	-	0,5	0,5	0,4	-	-
Displacement ULS $\delta_{N,seis}(ULS)$ [mm]	-	-	-	1,2	0,9	0,8	-	-

**Table C36: Displacement for threaded rods under shear loads for seismic category C2 in concrete**

Threaded rod, HIT-V-..., AM...8.8	M8	M10	M12	M16	M20	M24	M27	M30
Installation with seismic filling set								
Displacement DLS, HIT-V 8.8 / AM 8.8 $\delta_{V,seis}(DLS)$ [mm]	-	-	-	1,2	1,4	1,1	-	-
Displacement ULS, HIT-V 8.8 / AM 8.8 $\delta_{V,seis}(ULS)$ [mm]	-	-	-	3,2	3,7	1,1	-	-
Installation without seismic filling set								
Displacement ULS, HIT-V 8.8 / AM 8.8 $\delta_{V,seis}(DLS)$ [mm]	-	-	-	3,2	2,5	2,6	-	-
Displacement ULS, HIT-V 8.8 / AM 8.8 $\delta_{V,seis}(ULS)$ [mm]	-	-	-	9,2	7,1	10,2	-	-

Injection system Hilti HIT-RE 500 V3

### Performances

Characteristic values for seismic performance category C2 and displacements  
Design according to "EOTA Technical Report TR 045, 02/2013"

Annex C21