

Centre Scientifique et Technique du Bâtiment

84 avenue Jean Jaurès CHAMPS-SUR-MARNE F-77447 Marne-la-Vallée Cedex 2 Tél.: (33) 01 64 68 82 82 Fax: (33) 01 60 05 70 37





European Technical Assessment

ETA-20/0541 of 09/06/2023

English translation prepared by CSTB - Original version in French language

General Part

Technical Assessment Body issuing the European Technical Assessment:

Centre Scientifique et Technique du Batiment (CSTB)

Trade name: Injection system Hilti HIT-RE 500 V4

Product family: Bonded fastener with threaded rods, rebar, internally threaded

sleeve HIS-(R)N and Hilti Tension anchor HZA(-R) for use in

concrete for a working life of 50 and 100 years

Manufacturer: Hilti Corporation

Feldkircherstrasse 100

FL-9494 Schaan

Principality of Liechtenstein

Manufacturing plants: Hilti Plant

68 pages including 64 pages of annexes which form an

integral part of this assessment

Assessment contains:

This European Technical

This European Technical Assessment is issued in accordance with Regulation

accordance with Regulation (EU) No 305/2011, on the basis of:

EAD 330499-02-0601 version September 2022

This Assessment replaces: ETA-20/0541 dated 04/09/2021

Corrigendum

The European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and shall be identified as such. Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may only be made with the written consent of the issuing Technical Assessment Body. Any partial reproduction shall be identified as such. This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No 305/2011.

Specific Part

1 Technical description of the product

The Injection system Hilti HIT-RE 500 V4 is a bonded fastener consisting of a foil pack with injection mortar Hilti HIT-RE 500 V4 and a steel element.

These steel elements are:

- a threaded rod Hilti HAS, HAS-U, 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 and 3/8 in. to 1 1/4 in.
- a reinforcing bar (rebar) in the range of ϕ 8 to ϕ 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 and 3/8 in. to 3/4 in.

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 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 and 100 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 Annexes C1 to C28
Characteristic resistance for seismic performance category C1	See Annexes C29 to C35
Characteristic resistance for seismic performance category C2, Displacements	See Annexes C36 to C38

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Fasteners satisfy requirements for Class A1
Resistance to fire	See Annexes C39 to C42

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). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

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 1, 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
Bonded 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, as planned in the relevant EAD

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 following standards are referred to in this European Technical Assessment:

- EN 1992-1-1:2004 + AC:2010	Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
- EN 1992-1-2:2004 + AC:2008	Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design
- EN 1992-4:2018	Eurocode 2: Design of concrete structures – Part 4: Design of fastenings for use in concrete
- EN 1993-1-4:2006 + A1:2015	Eurocode 3: Design of steel structures, Part 1-4: General rules – Supplementary rules for stainless steels
- EN 1998-1:2004 + A1:2013	Eurocode 8: Design of structures for earthquake resistance - Part 1: General rules, seismic actions and rules for buildings
- EN 10088-1:2014	Stainless steels – Part 1: List of stainless steels
- EN 206:2013 + A2:2021	Concrete: Specification, performance, production and conformity

¹ Official Journal of the European Communities L 254 of 08.10.1996.

The control plan including confidential informations is not included in the published part of this ETA.

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 Notified Body shall visit the factory at least twice a year for surveillance of the manufacturer.

The original French version is signed by:

Anca Cronopol

Head of the Structure, Masonry, Partition Division

Installed condition

Figure A1: Threaded rod, HAS ..., HAS-U..., HAS-..., HIT-V-..., AM...

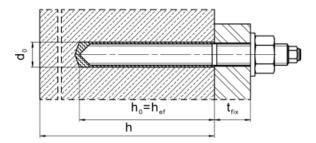


Figure A2: Threaded rod, HAS ..., HAS-U-..., HIT-V-..., AM..., with Hilti Filling Set...

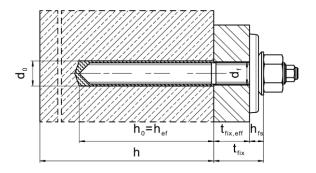


Figure A3: Internally threaded sleeve HIS-(R)N

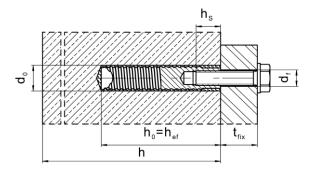
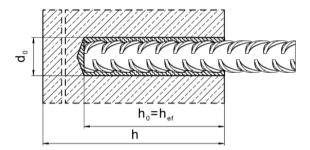


Figure A4: Reinforcing bar (rebar)



Injection system Hilti HIT-RE 500 V4

Product description Installed condition

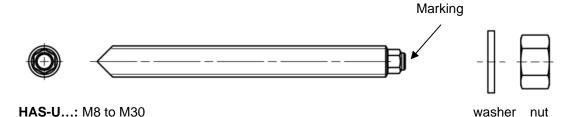




Static mixer Hilti HIT-RE-M



Steel elements



Marking: Steel grade number and length identification number

5 = HAS-U 5.8, 5.8 HDG 8 = HAS-U 8.8, 8.8. HDG

1 = HAS-U A4 2 = HAS-U HCR





washer nut

HAS ...: M8 to M30

HAS Color code marking:

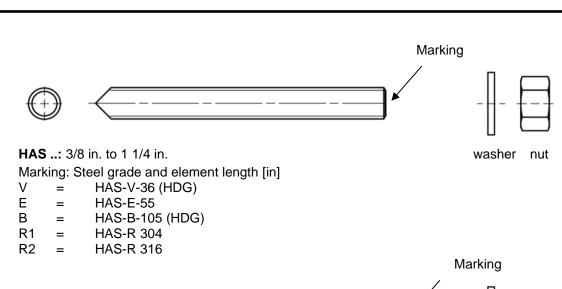
5.8 = RAL 5010 (blue) 8.8 = RAL 1023 (yellow) A4 = RAL 3000 (red)

AM ... **8.8: (HDG)** M8 to M30

Injection system Hilti HIT-RE 500 V4

Product description

Steel elements









washer nut

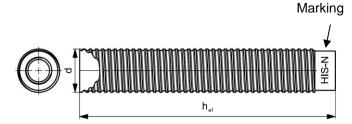
HIT-V-...: M8 to M30, 3/8 in. to 1 1/4 in.

Marking: e.g.,

5.8 - I = HIT-V-5.8 M...x I 5.8F - I = HIT-V-5.8F M...x I 8.8 - I = HIT-V-8.8 M...x I 8.8F - I = HIT-V-8.8F M...x I R - I = HIT-V-R M...x I HCR - I = HIT-V-HCR M...x I

Commercial standard threaded rod: M8 to M30, 3/8 in. to 1 1/4 in.

- Materials and mechanical properties according to Table A2.
- Inspection certificate 3.1 according to EN 10204. The document shall be stored.
- Marking of embedment depth.



Internally threaded sleeve HIS-(R)N: M8 to M20, 3/8 in. to 3/4 in.

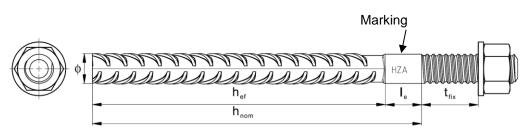
Marking:

Identifying mark - HILTI and embossing "HIS-N" (for zinc coated steel) or embossing "HIS-RN" (for stainless steel)

Injection system Hilti HIT-RE 500 V4

Product description

Steel elements



Hilti Tension anchor HZA: M12 to M27 Hilti Tension anchor HZA-R: M12 to M24

Marking:

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



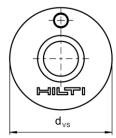
Reinforcing bar (rebar): ϕ 8 to ϕ 32

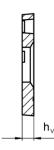
- Materials and mechanical properties according to Table A2.
- · Dimensions according to Annex B
- Minimum value of related rib area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar h_{rib} shall be in the range $0.05 \cdot \phi \le h_{rib} \le 0.07 \cdot \phi$ (ϕ : nominal diameter of the bar; h_{rib} : rib height of the bar)

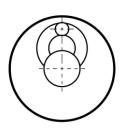
Hilti Filling Set to fill the annular gap between steel element and fixture

Sealing washer

Spherical washer







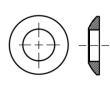


Table A1: Geometry of Hilti Filling Set

Hilti Filling Set			M8	M10	M12	M16	M20	M24
Diameter of sealing washer	d_{VS}	[mm]	38	42	44	52	60	70
Thickness of sealing washer	h_{VS}	[mm]		5			6	
Thickness of Hilti Filling Set	h_{fS}	[mm]	8	9	10	11	13	15

Injection system Hilti HIT-RE 500 V4

Product description Steel elements

Table A2: Materials

Designation	Material
Reinforcing bars (rebars	
Rebar EN 1992-1-1:2004 and AC:2010, Annex C	Bars and de-coiled rods class B or C with f_{yk} and k according to NDP or NCL of EN 1992-1-1/NA:2013 $f_{uk} = f_{tk} = k \cdot f_{yk}$
Steel elements made of a	zinc coated steel
HAS 5.8 (HDG), HAS-U 5.8 (HDG), HIT-V-5.8 (F), Threaded rod 5.8	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 μ m, (F) or (HDG) hot dip galvanized \geq 50 μ m
Threaded rod 6.8	Strength class 6.8, $f_{uk} = 600 \text{ N/mm}^2$, $f_{yk} = 480 \text{ N/mm}^2$ Elongation at fracture ($l_0 = 5d$) > 8% ductile Electroplated zinc coated $\geq 5 \mu\text{m}$, (F) or (HDG) hot dip galvanized $\geq 50 \mu\text{m}$
HAS 8.8 (HDG), HAS-U-8.8 (HDG), HIT-V-8.8 (F), AM 8.8 Threaded rod 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 $\geq 5 \mu\text{m}$, (F) or (HDG) hot dip galvanized $\geq 50 \mu\text{m}$
Hilti Tension anchor HZA	Round steel with threaded part: electroplated zinc coated ≥ 5 μm Rebar: bars class B according to NDP or NCL of EN 1992-1-1/NA
Internally threaded sleeve HIS-N	Electroplated zinc coated ≥ 5 μm
Threaded rod, HIT-V	ASTM A 307 Grade A, $f_{uk}=414$ N/mm², $f_{yk}=259$ N/mm² Elongation at fracture ($l_0=5d$) > 8% ductile Electroplated zinc coated $\geq 5~\mu m$
Threaded rod, HAS-V-36 (HDG)	ASTM F1554, Grade 36, $f_{uk}=400$ N/mm², $f_{yk}=248$ N/mm² Elongation at fracture ($l_0=5d$) > 23% ductile Electroplated zinc coated $\geq 5~\mu m$, (HDG) hot dip galvanized $\geq 53~\mu m$
Threaded rod, HAS-E-55	ASTM F1554, Grade 55, $f_{uk}=$ 517 N/mm², $f_{yk}=$ 379 N/mm² Elongation at fracture ($l_0=5d$) > 21% ductile Electroplated zinc coated $\geq 5~\mu m$
Threaded rod, HAS-B-105 (HDG)	ASTM F1554, Grade 105, $f_{uk}=862 \text{ N/mm}^2$, $f_{yk}=724 \text{ N/mm}^2$ Elongation at fracture ($l_0=5d$) > 15% ductile Electroplated zinc coated $\geq 5 \mu m$, (HDG) hot dip galvanized $\geq 53 \mu m$
Washer	Electroplated zinc coated ≥ 5 μm, hot dip galvanized ≥ 50 μm
Nut	Nominal strength class equal or higher to nominal strength class of rod Electroplated zinc coated \geq 5 μ m, hot dip galvanized \geq 50 μ m
Hilti Filling Set (F)	Filling washer: Electroplated zinc coated $\geq 5~\mu m$, (F) hot dip galvanized $\geq 50~\mu m$ Spherical washer: Electroplated zinc coated $\geq 5~\mu m$, (F) hot dip galvanized $\geq 50~\mu m$ Lock nut: Electroplated zinc coated $\geq 5~\mu m$, (F) Electroplated zinc-nickel coated 6 μm

Injection system	Hilti HIT-RE 500 V	4
------------------	--------------------	---

Product description Materials

Table A2: continued

Steel elements made of s	stainless steel
	(CRC II) acc. to EN 1993-1-4
Threaded rod	For \leq 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 ($l_0 = 5d$) $> 12\%$ ductile Stainless steel 1.4301, 1.4307, 1.4311, 1.4541, 1.4306, 1.4567 EN 10088-1
Washer	Stainless steel 1.4301, 1.4307, 1.4311, 1.4541, 1.4306, 1.4567 EN 10088-1
Nut	For \leq M24: strength class 70, $f_{uk}=700$ N/mm², $f_{yk}=450$ N/mm² For $>$ M24: strength class 50, $f_{uk}=500$ N/mm², $f_{yk}=210$ N/mm² Stainless steel 1.4301, 1.4307, 1.4311, 1.4541, 1.4306, 1.4567 according to EN 10088-1: 2014
Threaded rod, HAS-R 304	Size 3/8 in. to 5/8 in.: ASTM F593 CW1, $f_{uk} = 689 \text{ N/mm}^2$, $f_{yk} = 448 \text{ N/mm}^2$ Elongation at fracture ($l_0 = 5d$) > 12% ductile Size 3/4 in. to 1 in.: ASTM F593 CW2, $f_{uk} = 586 \text{ N/mm}^2$, $f_{yk} = 310 \text{ N/mm}^2$ Elongation at fracture ($l_0 = 5d$) > 12% ductile Size > 1 in.: ASTM A193 Grade 8(M), class 1, $f_{uk} = 515 \text{ N/mm}^2$, $f_{yk} = 205 \text{ N/mm}^2$ Elongation at fracture ($l_0 = 5d$) > 12% ductile
Washer	Stainless steel ASTM F593 and ASTM A193
Nut	Nominal strength class equal or higher to nominal strength class of rod
Steel elements made of steel corrosion resistance class	stainless steel (CRC III) acc. to EN 1993-1-4
HAS A4, HAS-U A4, HIT-V-R, Threaded rod A4	For \leq M24: strength class 70, $f_{uk} = 700 \text{ N/mm}^2$, $f_{yk} = 450 \text{ N/mm}^2$ For $>$ M24: strength class 50, $f_{uk} = 500 \text{ N/mm}^2$, $f_{yk} = 210 \text{ N/mm}^2$ Elongation at fracture ($l_0 = 5d$) $> 12\%$ ductile Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1
Hilti Tension anchor HZA-R	Round steel with threaded part: Stainless steel according to 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
Threaded rod, HAS-R 316	Size 3/8 in. to 5/8 in.: ASTM F593 CW1, $f_{uk} = 689 \text{ N/mm}^2$, $f_{yk} = 448 \text{ N/mm}^2$ Elongation at fracture ($l_0 = 5d$) > 12% ductile Size 3/4 in. to 1 1/4 in.: ASTM F 593 CW2, $f_{uk} = 586 \text{ N/mm}^2$, $f_{yk} = 310 \text{ N/mm}^2$ Elongation at fracture ($l_0 = 5d$) > 12% ductile
Washer	Stainless steel ASTM F593
Nut	Nominal strength class equal or higher to nominal strength class of rod
Hilti Filling Set A4	Filling washer: Stainless steel according to EN 10088-1 Spherical washer: Stainless steel according to EN 10088-1 Lock nut: Stainless steel according to EN 10088-1

Injection system	Hilti HIT-RE 500 V	4
------------------	--------------------	---

Product description

Materials

Table A2: continued

	de of high corrosion resistant steel e class (CRC V) acc. to EN 1993-1-4
HAS-U HCR, HIT-V-HCR, Threaded rod	For \leq M20: $f_{uk} = 800 \text{ N/mm}^2$, $f_{yk} = 640 \text{ N/mm}^2$ For $>$ M20: $f_{uk} = 700 \text{ N/mm}^2$, $f_{yk} = 400 \text{ N/mm}^2$ Elongation at fracture ($l_0 = 5d$) $> 12\%$ ductile High corrosion resistant steel 1.4529, 1.4565 EN 10088-1
Washer	High corrosion resistant steel 1.4529, 1.4565 EN 10088-1
Nut	Nominal strength class equal or higher to nominal strength class of rod High corrosion resistant steel 1.4529, 1.4565 EN 10088-1

Injection system Hilti HIT-RE 500 V4

Product description Materials

Specifications of intended use

Fasteners subject to:

- Static and quasi static loading.
- Seismic performance category C1.
- Seismic performance category C2 (HAS (8.8, 8.8 HDG, A4), HAS-U (8.8, 8.8 HDG, A4, HCR), HIT-V (-8.8, -8.8F, -R, -HCR), AM (8.8, 8.8 HDG) and standard threaded rod (grade 8.8, A4, HCR)), with hammer drilling and hammer drilling with Hilti hollow drill bit TE-CD, TE-YD.
- Fire exposure: threaded rod size M8 to M30 (HAS (5.8, 5.8 HDG, 8.8, 8.8 HDG, A4-70), (HAS-U (5.8, 5.8 HDG, 8.8, 8.8 HDG, A4-70, HCR), HIT-V (5.8, 5.8F, 8.8, 8.8F, R, HCR), 3/8 to 1 1/4 (HAS-E-55, HAS-B-105 (HDG)).

Base material:

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

Temperature in the base material:

at installation

-5°C to +40°C for the standard variation of temperature after installation

in-service

Temperature range I: -40°C to +40°C

(max. long term temperature +24°C and max. short term temperature +40°C)

Temperature range II: -40°C to +55°C

(max. long term temperature +43°C and max. short term temperature +55°C)

Temperature range III: -40°C to +75°C

(max. long term temperature +55°C and max. short term temperature +75°C)

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials).
- For all other conditions according EN 1993-1-4 corresponding to corrosion resistance classes Annex A (stainless steel and high corrosion resistant steel).

Design:

- Fasteners are designed under the responsibility of an engineer experienced in fasteners and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e. g. position of the fastener relative to reinforcement or to supports, etc.).
- The fasteners are designed in accordance with EN 1992-4 and EOTA Technical Report 055. Fasteners under seismic actions shall be positioned outside of critical regions (e.g., plastic hinges) of the concrete structure. Fastening in stand-off installation or with a grout layer under seismic action are not covered in this European technical assessment (ETA).
- For applications with resistance to fire exposure, the fasteners are designed in accordance with EOTA TR 082 "Design of bonded fasteners in concrete under fire conditions"

Injection system Hilti HIT-RE 500 V4	
Intended use Specifications	Annex B1

Installation:

- · Use category:
 - o dry or wet concrete (not in water-filled drill holes): for all drilling techniques.
 - o water-filled drill holes: for hammer drilling only, for uncracked concrete only.
- Drilling technique:
 - o hammer drilling,
 - o hammer drilling with Hilti hollow drill bit TE-CD, TE-YD,
 - o diamond coring, for uncracked concrete only,
 - o diamond coring with roughening with Hilti Roughening tool TE-YRT.
- Installation direction D3: downward, horizontal and upward (e.g., overhead) installation admissible for all elements.
- Fastener 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 V4	
Intended use Specifications	Annex B2

Table B1: Installation parameters of metric threaded rod according to Annex A

Metric threaded rod according to Annex A				M10	M12	M16	M20	M24	M27	M30
Diameter of element	d	[mm]	8	10	12	16	20	24	27	30
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22	28	30	35
Effective embedment depth and drill hole depth	h_{ef}	[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
Thickness of Hilti Filling Set	h_{fS}	[mm]	8	9	10	11	13	15	-	-
Effective fixture thickness with Hilti Filling Set	$t_{fix,eff}$	[mm]			t	$f_{fix,eff} =$	$t_{fix} + h_{fix}$	s		
Minimum thickness of concrete member	h_{min}	[mm]		$h_{ef} + 30 $ $\geq 100 mn$			h	$t_{ef} + 2 \cdot d$	l_0	
Maximum installation torque	max. T _{inst}	[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

Table B2: Installation parameters fractional threaded rod according to Annex A

	•						9		
Fractional threaded rod accord	ding to Anı	nex A	3/8	1/2	5/8	3/4	7/8	1	1 1/4
Diameter of element	d	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	31,8
Nominal diameter of drill bit	d_0	[in.]	7/16	9/16	3/4	7/8	1	1 1/8	1 3/8
Effective cross sectional area	$A_s^{1)}$	[mm²]	50	92	146	216	298	391	625
Effective embedment depth and drill hole depth	h_{ef}	[mm]	60 to 191	70 to 254	79 to 318	89 to 381	89 to 445	102 to 508	127 to 635
Maximum diameter of clearance hole in the fixture	d_f	[mm]	11,1	14,3	17,5	20,6	23,8	28,6	34,9
Minimum thickness of concrete member	h_{min}	[mm]		+ 30 0 mm		i	$h_{ef} + 2 \cdot d_0$)	
Maximum installation torque	max. T _{inst}	[Nm]	20	41	81	136	169	203	271
Minimum spacing	S_{min}	[mm]	45	60	80	90	105	115	140
Minimum edge distance	c_{min}	[mm]	45	45	50	55	60	70	80

¹⁾ Effective cross sectional area for calculation of characteristic steel resistance.

Injection system Hilti HIT-RE 500 V4

Intended use Installation parameters

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

HIS-(R)N			M8	M10	M12	M16	M20
Outer diameter of sleeve	d	[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}	[mm]	90	110	125	170	205
Maximum diameter of clearance hole in the fixture ³⁾	d_f	[mm]	9	12	14	18	22
Thickness of Hilti Filling Set	h_{fS}	[mm]	8	9	10	11	13
Effective fixture thickness with Hilti Filling Set	$t_{fix,eff}$	[mm]		t_{fi}	$x_{i,eff} = t_{fix} + h$	h_{fs}	
Minimum thickness of concrete member	h_{min}	[mm]	120	150	170	230	270
Maximum installation torque	max. T _{inst}	[Nm]	10	20	40	80	150
Thread engagement length min-max	$h_{\scriptscriptstyle S}$	[mm]	8 to 20	10 to 25	12 to 30	16 to 40	20 to 50
Minimum spacing	S_{min}	[mm]	60	75	90	115	130
Minimum edge distance	c_{min}	[mm]	40	45	55	65	90

Table B4: Installation parameters of internally threaded sleeve HIS-(R)N

	•		•		` '	
HIS-(R)N, size		[in.]	3/8	1/2	5/8	3/4
Outer diameter of sleeve	d	[mm]	16,5	20,5	25,4	27,6
Nominal diameter of drill bit	d_0	[in.]	11/16	7/8	1 1/8	1
Effective embedment depth and drill hole depth	h_{ef}	[mm]	110	125	170	205
Maximum diameter of clearance hole in the fixture	d_f	[mm]	11,1	14,3	17,5	20,6
Minimum thickness of concrete member	h_{min}	[mm]	150	170	230	270
Maximum installation torque	max. T _{inst}	[Nm]	20	41	81	136
Thread engagement length min to max	h_s	[mm]	10 to 25	12 to 30	16 to 40	20 to 50
Minimum spacing	Smin	[mm]	70	90	115	130
Minimum edge distance	c_{min}	[mm]	45	55	65	90

Injection system Hilti HIT-RE 500 V4

Intended use Installation parameters

Table B5: Installation parameters of Hilti Tension anchor HZA / HZA-R

HZA			M12	M16	M20	M24	M27	
HZA-R			M12	M16	M20	M24	-	
Rebar diameter	φ	[mm]	12	16	20	25	28	
Nominal embedment depth and drill hole depth HZA	h_0	[mm]	90 to 240	100 to 320	110 to 400	120 to 500	140 to 560	
Nominal embedment depth and drill hole depth HZA-R	h_0	[mm]	170 to 240	180 to 320	190 to 400	200 to 500	-	
Effective embedment depth HZA (hef = hnom - le)	h_{ef}	[mm]			$h_{nom}-20$			
Effective embedment depth HZA-R (hef = hnom - le)	h_{ef}	[mm]			$h_{nom}-100$			
Length of smooth shaft HZA	l_e	[mm]			20			
Length of smooth shaft HZA-R	l_e	[mm]			100			
Nominal diameter of drill bit	d_0	[mm]	16	20	25	32	35	
Maximum diameter of clearance hole in the fixture	d_f	[mm]	14	18	22	26	30	
Thickness of Hilti Filling Set	h_{fS}	[mm]	10	11	13	15	-	
Effective fixture thickness with Hilti Filling Set	$t_{fix,eff}$	[mm]	$t_{fix,eff} = t_{fix} - h_{fs} -$					
Maximum installation torque	max. T _{inst}	[Nm]	n] 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	

Table B6: Installation parameters of reinforcing bar (rebar)

	•														
Reinforcing bar (rebar)			φ8	φ10	φ:	12	φ14	φ16	φ18	φ20	φ24	φ25	φ28	φ30	φ32
Diameter	φ	[mm]	8	10	1	2	14	16	18	20	24	25	28	30	32
Effective embedment depth and drill hole depth	h_{ef}	[mm]	60 to 160	60 to 200	7 to 24	5	75 to 280	80 to 320	85 to 360	90 to 400	100 to 480	100 to 500	112 to 560	120 to 600	to
Nominal diameter of drill bit	d_0	[mm]	10 ¹⁾ 12 ¹⁾	12 ¹⁾ 14 ¹⁾	14 ¹⁾	16 ¹⁾	18	20	22	25	30 ¹⁾ 32 ¹⁾	30 ¹⁾ 32 ¹⁾	35	37	40
Minimum thickness of concrete member	h_{min}	[mm]		$\frac{100}{e_f} + 3$						h _{ef} +	$2 \cdot d_0$	1			
Minimum spacing	S_{min}	[mm]	40	50	6	0	70	80	90	100	125	125	140	150	160
Minimum edge distance	c_{min}	[mm]	40	45	4	5	50	50	60	65	70	70	75	80	80

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

Injection system Hilti HIT-RE 500 V4

Intended use

Installation parameters

Table B7: Working and curing time^{1) 2)}

Temperatu	re in th	ne base material	Maximum w t_{wo}	_		curing time $re^{1)}$
-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	hour	12	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

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 V4	
Intended use Working and curing time	Annex B5

The minimum temperature of the foil pack is +5°C.

Table B8: Parameters of cleaning and setting tools

	Steel el	ements			Installa- tion				
Metric threaded rod (Annex A)	HIS-(R)N	Rebar	HZA(-R)	Hamme	Hollow drill bit TE-CD, TE-YD ¹⁾		d coring Roughening tool TE-YRT	Brush	Piston plug
Dimminimin In		1717171717171							
Size	Size	Size	Size	d_0 [mm]	d_0 [mm]	d_0 [mm]	d_0 [mm]	HIT-RB	HIT-SZ
M8	ı	φ8	-	10	10	10	-	10	-
M10	ı	$\phi 8, \phi 10$	-	12	12	12	-	12	12
M12	M8	$\phi 10, \phi 12$	-	14	14	14	-	14	14
-	-	φ12	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	ϕ 18	-	22	22	22	22	22	22
-	-	ϕ 20	M20	25	25	25	25	25	25
M24	M16	-	-	28	28	28	28	28	28
M27	-	ϕ 24, ϕ 25	-	30	-	30	30	30	30
-	M20	ϕ 24, ϕ 25	M24	32	32	32	32	32	32
M30	-	φ28	M27	35	35	35	35	35	35
-	-	φ30	-	37	-	37	-	37	37
		422		40	-	-	-	40	40
-	-	φ32	-	-	-	42	-	42	42

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

Injection system Hilti HIT-RE 500 V4

Intended use

Overview of installation options / Parameters of cleaning and setting tools

Table B9: Parameters of cleaning and setting tools

Steel el	ements		Drill and clean						
		Hamı	mer drilling	Diamon	d coring				
Fractional threaded rod (Annex A)	HIS-(R)N		Hollow drill bit TE-CD, TE-YD ¹⁾		Roughen- ing tool TE-YRT	Brush	Piston plug		
mannanna Em				€ 👂 🗲					
Size [in]	Size [in]	d_0 [in.]	d_0 [in.]	d_0 [in.]	d_0 [in.]	HIT-RB	HIT-SZ		
3/8	-	7/16	-	7/16	-	7/16	7/16		
1/2	-	9/16	9/16	9/16	-	9/16	9/16		
-	3/8	11/16	-	11/16	-	11/16	11/16		
5/8	-	3/4	3/4	3/4	3/4	3/4	3/4		
3/4	1/2	7/8	7/8	7/8	7/8	7/8	7/8		
7/8	-	1	1	1	1	1	1		
1	5/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8		
-	3/4	1 1/4	-	1 1/4	-	1 1/4	1 1/4		
1 1/4	-	1 3/8	-	1 3/8	1 3/8	1 3/8	1 3/8		

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

Injection system Hilti HIT-RE 500 V4

Intended use

Overview of installation options / Parameters of cleaning and setting tools

Table B10: Cleaning alternatives

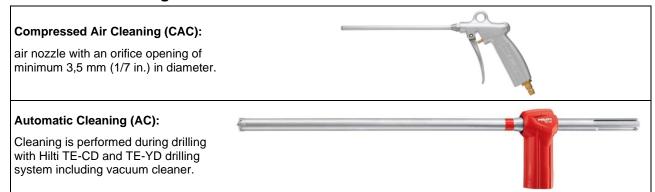


Table B11: Parameters for use of the Hilti Roughening tool TE-YRT

	Diamond coring		Roughening	tool TE-YRT	Wear gauge RTG		
	∮ ♦ →						
	d_0			 	0		
nominal [mm]	nominal [in.]	measured [mm]	d_0 [mm]	d_0 [in.]	si	ze	
18	3/4	17,9 to 18,2	18	3/4	18	3/4	
20	7/8	19,9 to 20,2	20	7/8	20	7/8	
22	1	21,9 to 22,2	22	1	22	1	
25	1 1/8	24,9 to 25,2	25	1 1/8	25	1 1/8	
28	1 3/8	27,9 to 28,2	28	1 3/8	28	1 3/8	
30	ı	29,9 to 30,2	30	-	30	•	
32	ı	31,9 to 32,2	32	-	32	-	
35	-	34,9 to 35,2	35	-	35	-	

Table B12: Using parameters of the Hilti Roughening tool TE-YRT

h_{ef} [mm]	Roughening time $t_{roughen}$ ($t_{roughen}$ [sec] = h_{ef} [mm] / 10)
0 to 100	10
101 to 200	20
201 to 300	30
301 to 400	40
401 to 500	50
501 to 600	60

Table B13: Hilti Roughening tool TE-YRT and wear gauge RTG



Injection system Hilti HIT-RE 500 V4

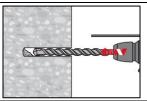
Intended use

Cleaning alternatives / Parameters for use of roughening tool

Installation instructions

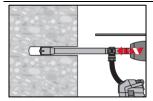
Hole drilling

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



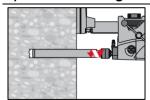
Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

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



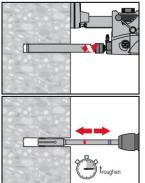
Drill hole to the required embedment depth with an appropriately sized Hilti hollow drill bit TE-CD or TE-YD attached to Hilti vacuum cleaner VC 10/20/40 (automatic filter cleaning activated, eco-mode off) or a vacuum cleaner providing equivalent performance in combination with the specified Hilti hollow drill bit TE-CD or TE-YD. This drilling system removes the dust and cleans the bore 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 and Table B9.

Before roughening free 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 hef.

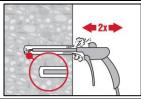
Injection system Hilti HIT-RE 500 V4

Intended use Installation instructions

Drill hole cleaning:

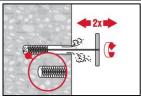
Just before setting the steel element, the drill hole must be free of dust and debris. Inadequate hole cleaning = poor load values.

Compressed Air Cleaning (CAC): For all drill hole diameters do and all drill hole depths ho.



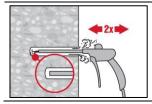
Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust.

For drill hole diameters \geq 32 mm the compressor has to supply a minimum air flow of 140 m³/h.



Brush 2 times with the specified brush (see Table B8 and Table B9) 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 $\phi \ge$ drill hole ϕ) - if not the brush is too small and must be replaced with the proper brush diameter.



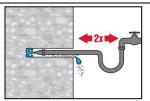
Blow again with compressed air 2 times until return air stream is free of noticeable dust.

Injection system Hilti HIT-RE 500 V4

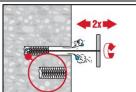
Intended use Installation instructions

Cleaning and water removal of water filled holes drilled with hammer drilling, hammer drilling with Hilti hollow drill bit and diamond coring

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

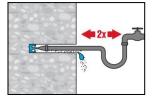


Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.

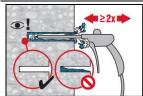


Brush 2 times with the specified brush (see Table B8 and Table B9) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.

The brush must produce natural resistance as it enters the drill hole (brush $\phi \ge$ drill hole ϕ) - if not the brush is too small and must be replaced with the proper brush diameter.

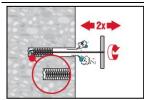


Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



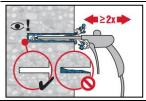
Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust and water.

For drill hole diameters \geq 32 mm the compressor has to supply a minimum air flow of 140 m³/h.



Brush 2 times with the specified brush size (see Table B8 and Table B9) 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.



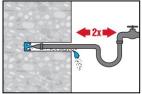
Blow again with compressed air 2 times until return air stream is free of noticeable dust and water.

Injection system Hilti HIT-RE 500 V4

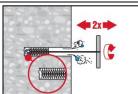
Intended use Installation instructions

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

For all drill hole diameters do and all drill hole depths ho.

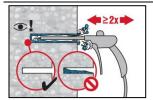


Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



Brush 2 times with the specified brush (see Table B8 and Table B9) 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.

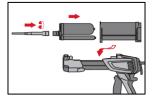
The brush must produce natural resistance as it enters the drill hole (brush $\phi \ge$ drill hole ϕ) - if not the brush is too small and must be replaced with the proper brush diameter



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 m³/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 m³/h.

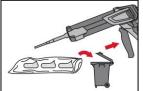
Injection preparation



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.

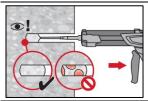
The minimum foil pack temperature is +5°C.

Injection system Hilti HIT-RE 500 V4

Intended use

Installation instructions

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

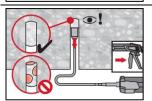


Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull.

Fill approximately 2/3 of the drill hole to ensure that the annular gap between the steel element and the concrete is completely filled with adhesive along the embedment length.

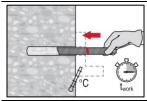


After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.



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 B8 and Table B9). 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.

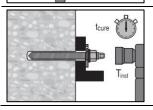
Setting the steel element



Before use, verify that the steel element is dry and free of oil and other contaminants. Mark and set steel element to the required embedment depth before working time t_{work} has elapsed. The working time t_{work} is given in Table B7.



For overhead installation use piston plugs and fix embedded parts with e.g., wedges.

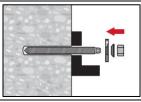


After required curing time t_{cure} (see Table B7) the fastening can be loaded. The applied installation torque shall not exceed the values max. T_{inst} given in Table B1 to Table B5.

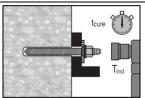
Injection system Hilti HIT-RE 500 V4

Intended use Installation instructions

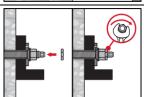
Installation of Hilti Filling Set



Use Hilti Filling Set with standard nut. Observe the correct orientation of filling washer and spherical washer.

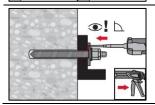


The applied installation torque shall not exceed the values max. T_{inst} given in Table B1 to Table B5.



Optional:

Installation of lock nut. Tighten with a 1/4 to 1/2 turn. (Not for size M24.)



Fill the annular gap between the anchor rod and fixture with 1-3 strokes of a Hilti injection mortar HIT-HY \dots or HIT-RE \dots

Follow the installation instructions supplied with the Hilti injection mortar.

After required curing time t_{cure} , the fastening can be loaded.

Injection system Hilti HIT-RE 500 V4

Intended use Installation instructions

Table C1: Essential characteristics for metric threaded rod according to Annex A under tension load in concrete

Metric threaded rod according to An	nex A		M8	M10	M12	M16	M20	M24	M27	M30
For a working life of 50 and 100 year	'S	•		•	•				•	•
Steel failure										
Characteristic resistance	$N_{Rk,s}$	[kN]				A_s ·	f_{uk}			
Partial factor grade 5.8, 6.8, 8.8 (Table A2)	$\gamma_{Ms,N}$ 1)	[-]				1	,5			
Partial factor HAS A4, HAS-U A4, HIT-V-R, Threaded rod: CRC II and III (Table A2)	γ _{Ms,N} ¹⁾	[-]	1,87 2,8						,86	
Partial factor HAS-U HCR, HIT-V-HCR, Threaded rod: CRC V (Table A2)	$\gamma_{Ms,N}$ 1)	[-]] 1,5 2,1							
Installation factor										
Hammer drilling	γ_{inst}	[-]				1	,0			
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD	Yinst	[-]				1	,0			
Diamond coring	γ_{inst}	[-]		1,2				1,4		
Diamond coring with roughening with Hilti Roughening tool TE-YRT	γ_{inst}	[-]		2)				1,0		
Hammer drilling in water-filled drill holes	Yinst	[-]				1	,4			
Concrete cone failure										
Factor for cracked concrete	$k_{cr,N}$	[-]				7	,7			
Factor for uncracked concrete	$k_{ucr,N}$	[-]				11	,0			
Edge distance	$c_{cr,N}$	[mm]				1,5	h_{ef}			
Spacing	$S_{cr,N}$	[mm]				3,0	h_{ef}			
Splitting failure	·	•								
	h/h _{ef}	≥ 2,0		$1,0 \cdot h_{ef}$		h/h _{ef} 2,0				
Edge distance c _{cr,sp} [mm] for	2,0 > h/h	$h_{ef} > 1,3$	4,6 ·	$h_{ef}-1$,8 · h	1,3			ļ	
	h/h _{ef}	≤ 1,3	,	$2,26 \cdot h_{e_j}$	f		1,0	h _{ef} 2,2	6 h _{ef}	C _{cr,sp}
Spacing	$S_{cr,sp}$	[mm]				$2 \cdot c$	cr,sp			

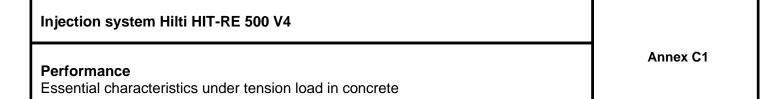


Table C1: continued (1)

Metric threaded rod a				M8	M10	M12	M16	M20	M24	M27	M30
Combined pullout and	l concrete con	e failure	for a worki	ng life	of 50 ye	ears					
Characteristic resistanc in hammer drilled holes a and diamond cored holes	and <mark>hammer dril</mark>	led holes	with Hilti ho			CD or TE	E-YD				
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	19	18	18	17	16	15	15	14
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	16	15	15	14	13	13	12	12
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	6,0	6,0	6,0	5,5	5,0	5,0	4,5	4,5
Characteristic resistance in diamond cored holes	e in uncracked	concrete	C20/25								
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	13	13	13	13	12	12	12	12
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	12	12	11	11	11	11	11	10
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	6,0	5,5	5,5	5,5	5,5	5,5	5,5	5,0
Characteristic resistance in hammer drilled holes a				es							
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	16	16	15	15	14	13	12	12
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	13	13	13	12	11	11	10	10
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	5,0	5,0	5,0	4,5	4,5	4,0	4,0	4,0
and diamond cored holes Temperature range I:	s with roughening 24°C / 40°C	ng with Hil $ au_{Rk,cr}$	ti Rougheni [N/mm²]	7,5	TE-YRT 9,0	11	11	10	9,5	9,0	8,5
Temperature range II:	43°C / 55°C	$ au_{Rk,cr}$	[N/mm ²]	7,0	8,0	9,0	8,5	8,0	8,0	7,5	7,0
Temperature range III:	55°C / 75°C	$ au_{Rk,cr}$	[N/mm ²]	4,0	3,5	3,5	3,5	3,0	3,0	3,0	3,0
Influence factors ψ or	n bond resistar	nce $ au_{Rk}$ ir	cracked a	nd und	racked	concre	te				
Influence of concrete st											
in hammer drilled holes a and diamond cored holes		led holes v	with Hilti ho	llow dril	I bit TE-	CD or TE					
Temperature range I to		ψ_c	[-]				$(f_{ck}/$	$(20)^{0,1}$			
in diamond cored holes v		with Hilti		tool TE							
Temperature range I to		ψ_c	[-]		2)				1,0		
Influence of sustained le						<u> </u>	- \/B				
in hammer drilled holes a and diamond cored holes	s with roughenir	ng with Hil	ti Rougheni			CD or TE					
Temperature range I:	24°C / 40°C	ψ_{sus}^0	[-]					88			
Temperature range II:	43°C / 55°C	ψ_{sus}^0	[-]					72			
Temperature range III:	55°C / 75°C	ψ_{sus}^0	[-]				0,	69			
In diamond cored holes	24°C / 40°C	2/10	r 1				0	90			
Temperature range I:	24°C / 40°C	$\psi^0_{sus} \ \psi^0_{sus}$	[-]					89 70			
Temperature range II:	43°C / 55°C		[-]					70			
Temperature range III:	55°C / 75°C	ψ_{sus}^0	[-]				U,	62			

Performance

Essential characteristics under tension load in concrete

Table C1: continued (2)

	cording to Ar			M8	M10	M12	M16	M20	M24	M27	M30
Combined pullout and	concrete con	e failure fo	r a worki	ng life	of 100 y	/ears					
Characteristic resistance in hammer drilled holes a and diamond cored holes	and <mark>hammer dril</mark>	led holes wi	th Hilti hol	low dril	I bit TE- TE-YRT	CD or TE	-YD				
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	19	18	18	17	16	15	15	14
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	15	15	15	14	13	13	12	11
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	6,0	6,0	6,0	5,5	5,0	5,0	4,5	4,5
Characteristic resistance in diamond cored holes	e in uncracked	concrete C	20/25								
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	13	13	13	13	12	12	12	12
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	$[N/mm^2]$	12	12	11	11	11	11	11	10
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	$[N/mm^2]$	6,0	5,5	5,5	5,5	5,5	5,5	5,5	5,0
Characteristic resistance in hammer drilled holes a				es							
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	16	16	15	15	14	13	12	12
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	$[N/mm^2]$	13	13	13	12	11	11	10	9,5
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	$[N/mm^2]$	5,0	5,0	5,0	4,5	4,5	4,0	4,0	4,0
in hammer drilled holes a and diamond cored holes	with roughening	ng with Hilti	Rougheni	ng tool	TE-YRT	ı				7.0	0.5
						CD or TE	-YD				
and diamond cored holes Temperature range I:	with roughening 24°C / 40°C	ng with Hilti $ au_{Rk,100,cr}$	Rougheni [N/mm ²]	7,0	TE-YRT 8,0	9,0	8,5	8,0	7,5	7,0	6,5
and diamond cored holes Temperature range I: Temperature range II:	with roughening 24°C / 40°C 43°C / 55°C	ng with Hilti $ au_{Rk,100,cr} au_{Rk,100,cr}$	Rougheni [N/mm²] [N/mm²]	7,0 6,0	8,0 7,0	9,0	8,5 7,5	7,0	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III:	24°C / 40°C 43°C / 55°C 55°C / 75°C	ng with Hilti $ au_{Rk,100,cr} au_{Rk,100,cr} au_{Rk,100,cr} au_{Rk,100,cr}$	Rougheni [N/mm²] [N/mm²] [N/mm²]	7,0 6,0 4,0	8,0 7,0 3,5	9,0 8,0 3,5	8,5 7,5 3,5		•		6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on	24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistar	ng with Hilti $ au_{Rk,100,cr} au_{Rk,100,cr} au_{Rk,100,cr} au_{Rk,100,cr}$	Rougheni [N/mm²] [N/mm²] [N/mm²]	7,0 6,0 4,0	8,0 7,0 3,5	9,0 8,0 3,5	8,5 7,5 3,5	7,0	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III:	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistant rength and hammer drill	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$	Rougheniu [N/mm²] [N/mm²] [N/mm²] in cracke	7,0 6,0 4,0	7,0 3,5 uncracl	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete	7,0	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on Influence of concrete string hammer drilled holes a	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistant rength and hammer drills	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$	Rougheniu [N/mm²] [N/mm²] [N/mm²] in cracke	7,0 6,0 4,0	7,0 3,5 uncracl	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete	7,0	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on Influence of concrete str in hammer drilled holes a and diamond cored holes	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistant rength and hammer drills.	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ led holes wi $ au_c$	Rougheni [N/mm²] [N/mm²] [N/mm²] in cracke th Hilti hol	7,0 6,0 4,0 d and d	8,0 7,0 3,5 uncracl	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete	7,0	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on Influence of concrete strin hammer drilled holes a and diamond cored holes Temperature range I to	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistant rength and hammer drills III:	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ led holes wi $ au_c$	Rougheni [N/mm²] [N/mm²] [N/mm²] in cracke th Hilti hol	7,0 6,0 4,0 d and d	8,0 7,0 3,5 uncracl	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete	7,0	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on Influence of concrete str in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes w Temperature range I to Influence of sustained Id	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistant rength and hammer drills III: with roughening III: boad	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ led holes wi $ au_c$ with Hilti R $ au_c$	Roughenin [N/mm²] [N/mm²] [N/mm²] in cracke th Hilti hol [-] oughening [-]	7,0 6,0 4,0 d and d	8,0 7,0 3,5 uncracl I bitTE-C	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete YD	7,0	6,5	6,5	
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on Influence of concrete str in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes w Temperature range I to	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistate rength and hammer drills with roughening III: boad and hammer drills with roughening with roughening	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ led holes wi $ au_c$ with Hilti R $ au_c$ led holes wing with Hilti	Roughening [N/mm²] [N/mm²] [N/mm²] in cracke th Hilti hol [-] oughening [-] th Hilti hol	7,0 6,0 4,0 d and d	8,0 7,0 3,5 uncracl I bitTE-C E-YRT 2)	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete YD	7,0	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on Influence of concrete str in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes w Temperature range I to Influence of sustained Ic in hammer drilled holes a	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistant rength and hammer drills ill: with roughening ill: bad and hammer drill and hammer drill and hammer drill	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ led holes with Hilti R $ au_c$ led holes wing with Hilti	Roughening [N/mm²] [N/mm²] [N/mm²] in cracke th Hilti hol [-] oughening [-] th Hilti hol	7,0 6,0 4,0 d and d	8,0 7,0 3,5 uncracl I bitTE-C E-YRT 2)	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete YD	7,0	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on Influence of concrete str in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes w Temperature range I to Influence of sustained Ic in hammer drilled holes a and diamond cored holes and diamond cored holes	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistant rength and hammer drills III: with roughening III: bad and hammer drills	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ led holes with Hilti R $ au_c$ led holes wing with Hilti $ au_c$ led holes wing with Hilti $ au_{sus,100}$	Roughening [N/mm²] [N/mm²] [N/mm²] in cracketh Hilti holoughening [-] th Hilti hol Roughening	7,0 6,0 4,0 d and d	8,0 7,0 3,5 uncracl I bitTE-C E-YRT 2)	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete -YD (f _{ck} /-	7,0 3,0 20) ^{0,1}	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on Influence of concrete str in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes w Temperature range I to Influence of sustained Ic in hammer drilled holes a and diamond cored holes Temperature range I to	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistant rength and hammer drills III: with roughening III: bad and hammer drills	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ led holes with Hilti R $ au_c$ led holes wing with Hilti $ au_{sus,100}$	Roughenin [N/mm²] [N/mm²] [N/mm²] in cracke th Hilti holoughening [-] th Hilti holonghening [-]	7,0 6,0 4,0 d and d	8,0 7,0 3,5 uncracl I bitTE-C E-YRT 2)	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete YD (f _{ck} /)	7,0 3,0 20) ^{0,1}	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on Influence of concrete str in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes was Temperature range I to Influence of sustained Ic in hammer drilled holes a and diamond cored holes Temperature range I: Temperature range II:	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistant rength and hammer drills ill: with roughening ill: bad and hammer drills with roughening and hammer drills with roughening 24°C / 40°C 43°C / 55°C	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ led holes with $ au_c$ with Hilti R $ au_c$ led holes wing with Hilti $ au_{sus,100}$ $ au_{sus,100}$ $ au_{sus,100}$ $ au_{sus,100}$	Roughenin [N/mm²] [N/mm²] [N/mm²] in cracke th Hilti hol [-] oughening [-] th Hilti hol Rougheni [-]	7,0 6,0 4,0 d and d	8,0 7,0 3,5 uncracl I bitTE-C E-YRT 2)	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete YD (f _{ck} /)	7,0 3,0 20) ^{0,1}	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors ψ on Influence of concrete str in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes w Temperature range I to Influence of sustained Ic in hammer drilled holes a and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Temperature range IIII: in diamond cored holes Temperature range IIII:	s with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C bond resistant rength and hammer drills ill: with roughening ill: bad and hammer drills with roughening and hammer drills with roughening 24°C / 40°C 43°C / 55°C	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ led holes with $ au_c$ with Hilti R $ au_c$ led holes wing with Hilti $ au_{sus,100}$ $ au_{sus,100}$ $ au_{sus,100}$	Roughenin [N/mm²] [N/mm²] [N/mm²] in cracke th Hilti hol [-] oughening [-] th Hilti hol Rougheni [-]	7,0 6,0 4,0 d and d	8,0 7,0 3,5 uncracl I bitTE-C E-YRT 2)	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete YD (<i>f_{ck}/</i> 2	7,0 3,0 20) ^{0,1}	6,5	6,5	6,0
and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Influence factors \$\psi\$ on Influence of concrete str in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes v Temperature range I to Influence of sustained Ic in hammer drilled holes a and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Temperature range IIII: in diamond cored holes	s with roughening 24°C / 40°C 43°C / 55°C bond resistant rength and hammer drills with roughening III: bad and hammer drills with roughening 24°C / 40°C 43°C / 55°C 55°C / 75°C	ng with Hilti $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ led holes with $ au_c$ with Hilti R $ au_c$ led holes wing with Hilti $ au_{sus,100}$ $ au_{sus,100}$ $ au_{sus,100}$ $ au_{sus,100}$	Roughenin [N/mm²] [N/mm²] [N/mm²] in cracke th Hilti hole [-] oughening [-] th Hilti hole Roughenin [-] [-] [-]	7,0 6,0 4,0 d and d	8,0 7,0 3,5 uncracl I bitTE-C E-YRT 2)	9,0 8,0 3,5 ked con	8,5 7,5 3,5 crete YD (<i>f_{ck}/</i> :	7,0 3,0 20) ^{0,1} 85 72 69	6,5	6,5	6,0

¹⁾ In absence of national regulations.

Injection system Hilti HIT-RE 500 V4

Performance

Essential characteristics under tension load in concrete

²⁾ No performance assessed.

Table C2: Essential characteristics for fractional threaded rod according to Annex A under tension load in concrete

Fractional threaded rod according t	o Annex A	[in.]	3/8	1/2	5/8	3/4	7/8	1	1 1/4
For a working life of 50 and 100 yea	rs								
Steel failure									
Characteristic resistance	$N_{Rk,s}$	[kN]				$A_s \cdot f_{uk}$			
Partial factor HIT-V	$\gamma_{Ms,N}$ 1)	[-]				1,92			
Partial factor HAS-V-36	$\gamma_{Ms,N}^{-1)}$	[-]				1,94			
Partial factor HAS-E-55	$\gamma_{Ms,N}$ 1)	[-]				1,64			
Partial factor HAS-B-105	$\gamma_{Ms,N}^{-1)}$	[-]				1,43			
Partial factor HAS-R 304	$\gamma_{Ms,N}$ 1)	[-]		1,85			2,27		3,01
Partial factor HAS-R 316	$\gamma_{Ms,N}^{1)}$	[-]	[-] 1,85 2,27						
Installation factor									
Hammer drilling	γ_{inst}	[-]				1,0			
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]	2)			1	,0		
Diamond coring	γ_{inst}	[-]	1	,2			1,4		
Diamond coring with roughening with Hilti Roughening tool TE-YRT	γ_{inst}	[-]	:	2)			1,0		
Hammer drilling in water-filled drill holes	γ_{inst}	[-]				1,4			
Concrete cone failure									
Factor for cracked concrete	$k_{cr,N}$	[-]				7,7			
Factor for uncracked concrete	$k_{ucr,N}$	[-]				11,0			
Edge distance	$c_{cr,N}$	[mm]				1,5 \cdot h_{ef}			
Spacing	$S_{cr,N}$	[mm]				$3,0 \cdot h_{ef}$			
Splitting failure									
	h/h_{ef}	≥ 2,0	1	$1,0 \cdot h_{ef}$		h/h _{ef} 4			
Edge distance c _{cr,sp} [mm] for	2,0 > h/h	_{ef} > 1,3	4,6 · 1	$h_{ef} - 1.8$	· h	1,3		\ 	
	h/h_{ef}	≤ 1,3	2	,26 \cdot h_{ef}			1,0 h _{ef} 2	2,26 h _{ef}	C _{cr,sp}
Spacing	$S_{cr,sp}$	[mm]				$2 \cdot c_{cr,sp}$			



Performance

Essential characteristics under tension load in concrete

Table C2: continued (1)

Fractional threaded ro	od according to	o Annex A	[in.]	3/8	1/2	5/8	3/4	7/8	1	1 1/4
Combined pullout and	d concrete con	e failure fo	or a worki	ng life c	of 50 yea	rs				
Characteristic resistanc in hammer drilled holes a and diamond cored holes	and hammer dril	led holes w	ith Hilti hol			or TE-YI)			
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	19	18	17	16	16	15	14
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	15	15	14	14	13	12	11
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	6,0	6,0	5,5	5,5	5,0	5,0	4,5
Characteristic resistanc in diamond cored holes	e in uncracked	concrete C	220/25							
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	13	13	13	12	12	12	12
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	12	11	11	11	11	11	10
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	5,5	5,5	5,5	5,5	5,5	5,5	5,0
Characteristic resistance in hammer drilled holes a				es						
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	$[N/mm^2]$	16	15	15	14	13	13	12
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	13	13	12	12	11	11	9,5
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	5,0	5,0	4,5	4,5	4,5	4,0	3,5
and diamond cored hole s Temperature range I:	s with roughening 24°C / 40°C	ng with Hilti $ au_{Rk,cr}$	[N/mm ²]	9,0	E-YRT	11	10	9,0	9,0	8,5
Temperature range II:	43°C / 55°C	$ au_{Rk,cr}$	[N/mm ²]	8,0	9,0	8,5	8,5	8,0	7,5	7,0
Temperature range III:	55°C / 75°C	$ au_{Rk,cr}$	[N/mm ²]	3,5	3,5	3,5	3,0	3,0	3,0	2,5
Influence factors ψ or	bond resistar	nce $ au_{Rk}$ in	cracked a	nd unci	acked c	oncrete	•			
Influence of concrete st	rength									
in hammer drilled holes a and diamond cored hole s		led holes w		low drill	bitTE-CD					
Temperature range I to		ψ_c	[-]			($(f_{ck}/20)^0$,1		
in diamond cored holes v			Ť							
Temperature range I to		ψ_c	[-]		2)			1,0		
Influence of sustained le		1111	241. 1 1224 1		L:: TT 6	\ TT \''				
in hammer drilled holes a and diamond cored holes	s with roughening	ng with Hilti	Rougheni			Or IE-YL				
Temperature range I:	24°C / 40°C	ψ_{sus}^0	[-]				0,88			
Temperature range II:	43°C / 55°C	ψ_{sus}^0	[-]				0,72			
Temperature range III:	55°C / 75°C	ψ_{sus}^0	[-]				0,69			
in diamond cored holes Temperature range I:	24°C / 40°C	ψ^0_{sus}	[-]				0,89			
Temperature range II:	43°C / 55°C	$\psi_{sus}^0 = \psi_{sus}^0$	[-]				0,89			
Temperature range III:	55°C / 75°C	$\frac{\psi_{sus}^0}{\psi_{sus}^0}$	[-]				0,70			
romperature range III.	33 0 / 13 0	Ψsus	[-]				0,02			

Performance

Essential characteristics under tension load in concrete

Table C2: continued (2)

Characteristic resistance in diamond cored holes Temperature range I: Temperature range III: Temperature range IIII: Characteristic resistance	e in uncracked nd hammer dril with roughenin 24°C / 40°C 43°C / 55°C 55°C / 75°C	concrete C led holes wing with Hilti $ au_{Rk,100,ucr}$ $ au_{Rk,100,ucr}$ $ au_{Rk,100,ucr}$	th Hilti hol Roughenii [N/mm²] [N/mm²]	llow drill	bit TE-CD		16	16	15	14
in hammer drilled holes ar and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Characteristic resistance in diamond cored holes Temperature range II: Temperature range II: Temperature range III: Characteristic resistance	nd hammer dril with roughenin 24°C / 40°C 43°C / 55°C 55°C / 75°C in uncracked 24°C / 40°C 43°C / 55°C	led holes wing with Hilti $ au_{Rk,100,ucr}$ $ au_{Rk,100,ucr}$ $ au_{Rk,100,ucr}$ concrete C	th Hilti hol Roughenii [N/mm²] [N/mm²]	19 15	E-YRT 18	17	16		15	14
Temperature range II: Temperature range III: Characteristic resistance in diamond cored holes Temperature range II: Temperature range III: Temperature range IIII: Characteristic resistance	43°C / 55°C 55°C / 75°C in uncracked 24°C / 40°C 43°C / 55°C	$ au_{Rk,100,ucr} \ au_{Rk,100,ucr} \ au_{concrete} \ $	[N/mm ²]	15					15	14
Temperature range III: Characteristic resistance in diamond cored holes Temperature range II: Temperature range III: Temperature range IIII: Characteristic resistance	55°C / 75°C in uncracked 24°C / 40°C 43°C / 55°C	$ au_{Rk,100,ucr}$ concrete C	[N/mm ²]		15	14	40			1
Characteristic resistance in diamond cored holes Temperature range I: Temperature range III: Temperature range IIII: Characteristic resistance	in uncracked 24°C / 40°C 43°C / 55°C	concrete C		6.0			13	13	12	11
in diamond cored holes Temperature range I: Temperature range II: Temperature range III: Characteristic resistance	24°C / 40°C 43°C / 55°C		20/25	- , -	6,0	5,5	5,5	5,0	5,0	4,5
Temperature range II: Temperature range III: Characteristic resistance	43°C / 55°C	$ au_{Rk,100,ucr}$								
Temperature range III: Characteristic resistance			[N/mm ²]	13	13	13	12	12	12	12
Characteristic resistance	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	12	11	11	11	11	11	10
		$\tau_{Rk,100,ucr}$	[N/mm ²]	5,5	5,5	5,5	5,5	5,5	5,5	5,0
III Halliller utilieu lioles al	e in uncracked nd installation i			es						
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	16	15	15	14	13	13	12
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	13	12	12	11	11	10	9,5
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	5,0	5,0	4,5	4,5	4,5	4,0	3,5
in hammer drilled holes at and diamond cored holes Temperature range I: Temperature range II:		ng with Hilti				8,5 7,5	8,0 7,0	7,5 7,0	7,5 6,5	6,5 6,0
	55°C / 75°C		[N/mm ²]	3,5	3,5	3,5	3,0	3,0	3,0	2,5
Influence factors ψ on		,,	1					0,0	0,0	2,0
Influence of concrete stre		100 t _{RK,100}	III OI GORG	a una u	Horacito	4 0011010				
in hammer drilled holes and diamond cored holes		led holes wi	th Hilti hol	llow drill	bitTE-CD	or TE-YD				
Temperature range I to I	II:	ψ_c	[-]			($f_{ck}/20)^{0,}$	1		
in diamond cored holes w	ith roughening	with Hilti R	oughening	tool TE-	-YRT					_
Temperature range I to I	II:	ψ_c	[-]	2	2)			1,0		
Influence of sustained lo										
in hammer drilled holes and diamond cored holes	with roughenir	ng with Hilti				or TE-Y)			
<u> </u>	24°C / 40°C	1 343,100	[-]				0,85			
Temperature range II:	43°C / 55°C		[-]				0,72			
Temperature range III:	55°C / 75°C	$\psi^0_{sus,100}$	[-]				0,69			
in diamond cored holes										
Temperature range I:	24°C / 40°C	$\psi^0_{sus,100}$	[-]				0,70			
	43°C / 55°C	$\psi^0_{sus,100}$	[-]				0,67			
Temperature range II:		$\psi^0_{sus,100}$	[-]				0,62			

¹⁾ In absence of national regulations.

Injection system Hilti HIT-RE 500 V4

Performance

Essential characteristics under tension load in concrete

²⁾ No performance assessed.

Table C3: Essential characteristics 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_{nom}	[mm]	12,5	16,5	20,5	25,4	27,6
For a working life of 50 and 100 year							
Steel failure							
Characteristic resistance HIS-N with screw grade 8.8	$N_{Rk,s}$	[kN]	25	46	67	125	116
Partial factor	$\gamma_{Ms,N}^{1)}$	[-]			1,5		
Characteristic resistance HIS-RN with screw grade 70	$N_{Rk,s}$	[kN]	26	41	59	110	166
Partial factor	$\gamma_{Ms,N}^{1)}$	[-]		1	,87		2,4
Installation factor							
Hammer drilling	γ_{inst}	[-]			1,0		
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]			1,0		
Diamond coring	γ_{inst}	[-]	1,2		1	,4	
Diamond coring with roughening with Hilti Roughening tool TE-YRT	γ_{inst}	[-]	2)		1	,0	
Hammer drilling in water-filled drill holes	Yinst	[-]			1,4		
Concrete cone failure							
Factor for cracked concrete	$k_{cr,N}$	[-]			7,7		
Factor for uncracked concrete	$k_{ucr,N}$	[-]			11,0		
Edge distance	$c_{cr,N}$	[mm]			1,5 \cdot h_{ef}		
Spacing	$S_{cr,N}$	[mm]			$3,0 \cdot h_{ef}$		
Splitting failure					-		
	h/h _{ef}	≥ 2,0	1,0 ·	h_{ef}	h/h _{ef} 4		
Edge distance c _{cr,sp} [mm] for	2,0 > h/h	$n_{ef} > 1.3$	$4,6 \cdot h_{ef}$ -	- 1,8 · h	1,3		
	h/h_{ef}	≤ 1,3	2,26 ·	h_{ef}		1,0 h _{ef} 2,26 h _{ef}	C _{cr,sp}
Spacing	$s_{cr,sp}$	[mm]			$2 \cdot c_{cr,sp}$		



Essential characteristics under tension load in concrete

Table C3: continued (1)

HIS-(R)N				М8	M10	M12	M16	M20
Outer diameter of sleev	'e	d_{nom}	[mm]	12,5	16,5	20,5	25,4	27,6
Combined pullout and	l concrete con	e failure	for a workir	ng life of 5	0 years			
Characteristic resistand in hammer drilled holes a and diamond cored holes	and <mark>hammer dril</mark>	led holes	with Hilti holl			YD		
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	14	14	14	14	14
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	12	12	12	12	12
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	4,5	4,5	4,5	4,5	4,5
Characteristic resistand in diamond cored holes	e in uncracked	concrete	C20/25					
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	8,5	9,0	9,5	10	10
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	8,0	8,0	8,5	9,0	9,0
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	4,0	4,0	4,0	4,5	4,5
Characteristic resistance in hammer drilled holes a				s				
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	12	12	12	12	12
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	10	10	10	10	10
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	4,0	4,0	4,0	4,0	4,0
	24°C / 40°C	ng with Hil τ _{Rk,cr}	[N/mm ²]	9,0	9,0	9,0	9,0	9,0
Temperature range I:	24°C / 40°C	$ au_{Rk,cr}$	[N/mm ²]	9,0	9,0	9,0	9,0	9,0
Temperature range II:	43°C / 55°C	$ au_{Rk,cr}$	[N/mm ²]	8,0	8,0	8,0	8,0	8,0
Temperature range III:		$ au_{Rk,cr}$	[N/mm ²]	3,0	3,0	3,0	3,0	3,0
Influence factors ψ or	bond resista	nce $ au_{Rk}$ ir	n cracked ai	nd uncracl	ked concrete	•		
Influence of concrete st	<u> </u>							
in hammer drilled holes a and diamond cored holes		led holes	with Hilti holl	ow drill bit	TE-CD or TE-Y			
Temperature range I to	III:	ψ_c	[-]			$(f_{ck}/20)^{0,1}$		
in diamond cored holes		with Hilti	T T		Ţ			
Temperature range I to		ψ_c	[-]	2)		1	,0	
Influence of sustained l								
in hammer drilled holes a and diamond cored holes	s with rougheni	ng with Hil	lti Roughenin					
Temperature range I:	24°C / 40°C	ψ_{sus}^0	[-]			0,88		
Temperature range II:	43°C / 55°C	ψ^0_{sus}	[-]			0,72		
Temperature range III:	55°C / 75°C	ψ_{sus}^0	[-]			0,69		
in diamond cored holes	0.400 / 4000					0.00		
Temperature range I:	24°C / 40°C	ψ_{sus}^0	[-]			0,89		
Temperature range II:	43°C / 55°C	ψ^0_{sus}	[-]			0,70		
Temperature range III:	55°C / 75°C	ψ_{sus}^0	[-]			0,62		

Injection system	Hilti HIT-RE 500 V	4
------------------	--------------------	---

Performance

Essential characteristics under tension load in concrete

Table C3: continued (2)

				М8	M10	M12	M16	M20
Outer diameter of sleev	'e	d_{nom}	[mm]	12,5	16,5	20,5	25,4	27,6
Combined pullout and	d concrete con	e failure fo	or a workir	ng life of 10	00 years			
Characteristic resistanc in hammer drilled holes a and diamond cored holes	and hammer dri l	led holes w	ith Hilti holl			YD		
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	14	14	14	14	14
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	11	11	11	11	11
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	4,5	4,5	4,5	4,5	4,5
Characteristic resistanc in diamond cored holes	e in uncracked	concrete C	20/25					
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	8,5	9,0	9,5	10	10
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	8,0	8,0	8,5	9,0	9,0
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	4,0	4,0	4,0	4,5	4,5
Characteristic resistance in hammer drilled holes a				es				
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	12	12	12	12	12
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	9,5	9,5	9,5	9,5	9,5
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	4,0	4,0	4,0	4,0	4,0
and diamond cored holes Temperature range I: Temperature range II:	24°C / 40°C 43°C / 55°C	$ au_{Rk,100,cr}$	[N/mm ²]	7,0 6,0	7,0 6,5	7,0 6,5	7,0 6,5	7,0 6,5
						,		
Temperature range III:		,	[N/mm ²]	3,0	3,0	3,0	3.0	3,0
Influence factors ψ on		$ au_{Rk,100,cr}$					0,0	0,0
	i boliu lesista	1106 t _{Rk,100}	III CI acke	a and unci	acked conc	icic		
Influence of concrete st	renath							
Influence of concrete st in hammer drilled holes a and diamond cored holes	and hammer dril	led holes w	ith Hilti holl	low drill bitT	E-CD or TE-Y	′D		
in hammer drilled holes a and diamond cored holes	and hammer dril s	led holes w ψ_c	ith Hilti holl	ow drill bitT	E-CD or TE-\	$(f_{ck}/20)^{0,1}$		
in hammer drilled holes a and diamond cored holes Temperature range I to	and hammer dril s III:	ψ_c	[-]	tool TE-YR				
in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes we Temperature range I to	and hammer drils s III: with roughening	ψ_c	[-]			$(f_{ck}/20)^{0,1}$,0	
in hammer drilled holes a and diamond cored holes. Temperature range I to in diamond cored holes were Temperature range I to Influence of sustained le	and hammer dril s III: with roughening III: oad	ψ_c) with Hilti R ψ_c	[-] oughening [-]	tool TE-YR	r	$(f_{ck}/20)^{0,1}$,0	
in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes we Temperature range I to	and hammer dril s III: with roughening III: oad and hammer dril s with roughening	ψ_c J with Hilti R ψ_c led holes w	[-] oughening [-] ith Hilti holl Roughenin	tool TE-YR	TE-CD or TE-	$(f_{ck}/20)^{0,1}$,0	
in hammer drilled holes a and diamond cored holes. Temperature range I to in diamond cored holes with Temperature range I to Influence of sustained I in hammer drilled holes a and diamond cored holes. Temperature range I:	and hammer dril s III: with roughening III: oad and hammer dril s with roughening 24°C / 40°C	ψ_c J with Hilti R ψ_c led holes w ng with Hilti $\psi^0_{sus,100}$	[-] oughening [-] ith Hilti holl Roughenin	tool TE-YR	TE-CD or TE-	$\frac{(f_{ck}/20)^{0,1}}{1}$,0	
in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes we Temperature range I to Influence of sustained lo in hammer drilled holes a and diamond cored holes Temperature range I:	and hammer dril s III: with roughening III: oad and hammer dril s with roughenin 24°C / 40°C 43°C / 55°C	ψ_c) with Hilti R ψ_c led holes w ng with Hilti $\psi^0_{sus,100}$ $\psi^0_{sus,100}$	[-] oughening [-] ith Hilti holl Roughenin	tool TE-YR	TE-CD or TE-	$(f_{ck}/20)^{0,1}$,0	
in hammer drilled holes a and diamond cored holes. Temperature range I to in diamond cored holes with Temperature range I to Influence of sustained I in hammer drilled holes a and diamond cored holes. Temperature range I:	and hammer dril s III: with roughening III: oad and hammer dril s with roughening 24°C / 40°C	ψ_c) with Hilti R ψ_c led holes w ng with Hilti $\psi^0_{sus,100}$ $\psi^0_{sus,100}$	[-] oughening [-] ith Hilti holl Roughenin	tool TE-YR	TE-CD or TE-	$\frac{(f_{ck}/20)^{0,1}}{1}$,00	
in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes we Temperature range I to Influence of sustained lo in hammer drilled holes a and diamond cored holes Temperature range I:	and hammer dril s III: with roughening III: oad and hammer dril s with roughenin 24°C / 40°C 43°C / 55°C 55°C / 75°C	ψ_c I with Hilti R ψ_c led holes w ng with Hilti $\psi^0_{sus,100}$ $\psi^0_{sus,100}$ $\psi^0_{sus,100}$	[-] oughening [-] ith Hilti holl Roughenin [-] [-]	tool TE-YR	TE-CD or TE-	$\frac{(f_{ck}/20)^{0,1}}{1}$,0	
in hammer drilled holes a and diamond cored holes and diamond cored holes in diamond cored holes in diamond cored holes in hammer drilled holes and diamond cored holes Temperature range I: Temperature range II: Temperature range III:	and hammer dril s III: with roughening III: oad and hammer dril s with roughenin 24°C / 40°C 43°C / 55°C	ψ_c) with Hilti R ψ_c led holes w ng with Hilti $\psi^0_{sus,100}$ $\psi^0_{sus,100}$	[-] oughening [-] ith Hilti holl Roughenin [-]	tool TE-YR	TE-CD or TE-	$\frac{(f_{ck}/20)^{0,1}}{1}$,0	
in hammer drilled holes a and diamond cored holes. Temperature range I to in diamond cored holes with the cored holes of the cored holes and diamond cored holes. Temperature range I: Temperature range II: Temperature range III: Temperature range III: in diamond cored holes.	and hammer dril s III: with roughening III: oad and hammer dril s with roughenin 24°C / 40°C 43°C / 55°C 55°C / 75°C	ψ_c I with Hilti R ψ_c led holes w ng with Hilti $\psi^0_{sus,100}$ $\psi^0_{sus,100}$ $\psi^0_{sus,100}$	[-] oughening [-] ith Hilti holl Roughenin [-] [-]	tool TE-YR	TE-CD or TE-	$\frac{(f_{ck}/20)^{0,1}}{1}$,0	

¹⁾ In absence of national regulations.

Injection system Hilti HIT-RE 500 V4

Performance

Essential characteristics under tension load in concrete

²⁾ No performance assessed.

Table C4: Essential characteristics for internally threaded sleeve HIS-(R)N under tension load in concrete

HIS-(R)N, size		[in.]	3/8	1/2	5/8	3/4
Outer diameter of sleeve	d_{nom}	[mm]	16,5	20,5	25,4	27,6
For a working life of 50 and 100 year		•				
Steel failure						
Characteristic resistance HIS-N Screw acc. to SAE J429 Grade 5 or ASTM A325 (1/2 in. to 3/4 in.)	$N_{Rk,s}$	[kN]	41	76	121	130
Partial factor	$\gamma_{Ms,N}^{1)}$	[-]	1,57		1,50	
Characteristic resistance HIS-N Screw acc. to ASTM A193 Grade B7	$N_{Rk,s}$	[kN]	43	77	128	130
Partial factor	$\gamma_{Ms,N}^{1)}$	[-]	1,43 1,50			
Characteristic resistance HIS-RN Screw acc. to ASTM A193 Grade B8M	$N_{Rk,s}$	[kN]	38	110	182	185
Partial factor	$\gamma_{Ms,N}^{-1)}$	[-]	1,40		2,40	
Characteristic resistance HIS-RN Screw acc. to ASTM A193 Grade B8T	$N_{Rk,s}$	[kN]	43	110	182	185
Partial factor	$\gamma_{Ms,N}$ 1)	[-]	1,50		2,40	
Installation factor						
Hammer drilling	γ_{inst}	[-]	1,0			
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD	Yinst	[-]	2)	1,0		2)
Diamond coring	γ_{inst}	[-]	1,4			
Diamond coring with roughening with Hilti Roughening tool TE-YRT	γ_{inst}	[-]	2) 1,0		2)	
Hammer drilling in water-filled drill holes	γ_{inst}	[-]	1,4			
Concrete cone failure						
Factor for cracked concrete	$k_{cr,N}$	[-]	7,7			
Factor for uncracked concrete	$k_{ucr,N}$	[-]	11,0			
Edge distance	$c_{cr,N}$	[mm]	1,5 \cdot h_{ef}			
Spacing	$S_{cr,N}$	[mm]	$3.0 \cdot h_{ef}$			
Splitting failure						
	$h/h_{ef} \ge 2.0$		$1,0 \cdot h_{e_j}$	h/h _{ef}		
Edge distance c _{cr,sp} [mm] for	$2,0 > h/h_{ef} > 1,3$		$4,6 \cdot h_{ef} - 1$	1,8 · h	1,3	
	$h/h_{ef} \le 1.3$		$2,26 \cdot h_{\epsilon}$,	-	26 h _{ef} C _{cr,sp}
Spacing	$S_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$			



Performance

Essential characteristics under tension load in concrete

Table C4: continued (1)

HIS-(R)N, size			[in.]	3/8	1/2	5/8	3/4
Outer diameter of sleev	re	d_{nom}	[mm]	16,5	20,5	25,4	27,6
Combined pullout and	concrete con		for a workir	ng life of 50 ye	ears		
Characteristic resistanc in hammer drilled holes a and diamond cored holes	and hammer dril l	ed holes v	with Hilti holl		CD or TE-YD		
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	14	14	14	14
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	12	12	12	12
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	4,5	4,5	4,5	4,5
Characteristic resistanc in diamond cored holes	e in uncracked	concrete	C20/25				
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	9,0	9,5	10	10
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	8,0	8,5	9,0	9,0
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	4,0	4,0	4,5	4,5
Characteristic resistanc in hammer drilled holes a				s			
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	12	12	12	12
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	10	10	10	10
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	4,0	4,0	4,0	4,0
in hammer drilled holes a and diamond cored holes Temperature range I:					9,0	9,0	9,0
Temperature range II:		$ au_{Rk,cr}$	[N/mm ²]	8,0	8,0	8,0	8,0
Temperature range III:		$\tau_{Rk,cr}$	[N/mm ²]	3,0	3,0	3,0	3,0
Influence factors ψ on						-,0	0,0
Influence of concrete st		AK					
in hammer drilled holes a and diamond cored holes	and hammer dril l	led holes v	with Hilti holl	ow drill bitTE-0	CD or TE-YD		
Temperature range I to	III:	ψ_c	[-]		$(f_{ck}/2)$	$(20)^{0,1}$	
in diamond cored holes v	with roughening	with Hilti	Roughening	tool TE-YRT			1
Temperature range I to		ψ_c	[-]	2)	1,	0	2)
Influence of sustained lo							
in hammer drilled holes a and diamond cored holes	s with roughenir	ng with Hil	ti Roughenin		CD or TE-YD		
Temperature range I:	24°C / 40°C	ψ_{sus}^0	[-]		0,8		
Temperature range II:	43°C / 55°C	ψ^0_{sus}	[-]		0,7		
Temperature range III:	55°C / 75°C	ψ^0_{sus}	[-]		0,6	69	
in diamond cored holes	0.400 / 4000		.,1				
Temperature range I:	24°C / 40°C	ψ_{sus}^{0}	[-]		0,8		
Temperature range II:	43°C / 55°C	ψ_{sus}^0	[-]		0,7		
Temperature range III:	55°C / 75°C	ψ^0_{sus}	[-]		0,6	02	

Injection system	Hilti HIT-RE 500 V	4
------------------	--------------------	---

Performance

Essential characteristics under tension load in concrete

Table C4: continued (2)

Outer diameter of sleev Combined pullout and Characteristic resistand in hammer drilled holes a		d_{nom}	f				
Characteristic resistance in hammer drilled holes a	_	Tioni	[mm]	16,5	20,5	25,4	27,6
in hammer drilled holes	d concrete con		r a workin	g life of 100	years		
and diamond cored holes	and hammer dril	led holes wit	h Hilti holl		CD or TE-YD		
Temperature range I:	24°C / 40°C	$\tau_{Rk,100,ucr}$ [[N/mm ²]	14	14	14	14
Temperature range II:	43°C / 55°C	$\tau_{Rk,100,ucr}$ [[N/mm ²]	11	11	11	11
Temperature range III:	55°C / 75°C	$\tau_{Rk,100,ucr}$ [[N/mm ²]	4,5	4,5	4,5	4,5
Characteristic resistance in diamond cored holes	e in uncracked	concrete C2	20/25				
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$ [9,0	9,5	10	10
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$ [[N/mm ²]	8,0	8,5	9,0	9,0
Temperature range III:	55°C / 75°C	$\tau_{Rk,100,ucr}$ [[N/mm ²]	4,0	4,0	4,5	4,5
Characteristic resistance in hammer drilled holes a				s			
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$ [[N/mm ²]	12	12	12	12
Temperature range II:	43°C / 55°C	$\tau_{Rk,100,ucr}$ [[N/mm ²]	9,5	9,5	9,5	9,5
Temperature range III:	55°C / 75°C	$\tau_{Rk,100,ucr}$ [[N/mm ²]	4,0	4,0	4,0	4,0
Characteristic resistance in hammer drilled holes a and diamond cored holes	and hammer dril s with roughenii	led holes wit ng with Hilti F	h Hilti holl Roughenin	g tool TE-YRT	T		T
Temperature range I:	24°C / 40°C	11.0,100,07	[N/mm ²]	7,0	7,0	7,0	7,0
Temperature range II:	43°C / 55°C	,,	[N/mm ²]	6,5	6,5	6,5	6,5
Temperature range III:				3,0	3,0	3,0	3,0
Influence factors ψ or		nce $ au_{Rk,100}$ i	n cracked	and uncraci	ked concrete		
Influence of concrete st					- TE VD		
in hammer drilled holes a and diamond cored holes		led holes wit	n Hilti holi	ow drill bit i E-C	OD OF TE-YD		
Temperature range I to		ψ_c	[-]		$(f_{ck}/2)$	$(20)^{0,1}$	
in diamond cored holes				tool TE-YRT	0 0		
Temperature range I to	III:	ψ_c	[-]	2)	1,	0	2)
Influence of sustained I							
in hammer drilled holes a and diamond cored holes	s with roughenii	ng with Hilti F			CD or TE-YD		
Temperature range I:	24°C / 40°C	$\psi^0_{sus,100}$	[-]		0,8	85	
Temperature range II:	43°C / 55°C	$\psi^0_{sus,100}$	[-]		0,	72	
Temperature range III:	55°C / 75°C	$\psi^0_{sus,100}$	[-]		0,0	69	
in diamond cored holes				_			
Temperature range I:	24°C / 40°C	$\psi^0_{sus,100}$	[-]		0,	70	
Temperature range II:	43°C / 55°C	$\psi^0_{sus,100}$	[-]		0,0	67	
1	55°C / 75°C	$\psi^0_{sus,100}$	[-]		0,0	22	

¹⁾ In absence of national regulations.

Injection system Hilti HIT-RE 500 V4

Performance

Essential characteristics under tension load in concrete

²⁾ No performance assessed.

Table C5: Essential characteristics for Hilti Tension anchor HZA / HZA-R under tension load in concrete

HZA / HZA-R			M12	M16	M20	M24	M27
Rebar diameter	φ	[mm]	12	16	20	25	28
For a working life of 50 and 100 year	rs						
Steel failure							
Characteristic resistance HZA	$N_{Rk,s}$	[kN]	46	86	135	194	253
Characteristic resistance HZA-R	$N_{Rk,s}$	[kN]	62	111	173	248	1)
Partial factor	$\gamma_{Ms,N}$ 1)	[-]			1,4		
Installation factor							
Hammer drilling	γ_{inst}	[-]			1,0		
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]			1,0		
Diamond coring	γ_{inst}	[-]	1,2		1	,4	
Diamond coring with roughening with Hilti Roughening tool TE-YRT	γ_{inst}	[-]	2)		1	,0	
Hammer drilling in water-filled drill holes	γ_{inst}	[-]			1,4		
Concrete cone failure							
Factor for cracked concrete	$k_{cr,N}$	[-]			7,7		
Factor for uncracked concrete	$k_{ucr,N}$	[-]			11,0		
Edge distance	$c_{cr,N}$	[mm]			1,5 \cdot h_{ef}		
Spacing	$S_{cr,N}$	[mm]			$3,0 \cdot h_{ef}$		
Splitting failure							
	h/h_{ef}	≥ 2,0	1,0 ·	h_{ef}	h/h _{ef} ♠		
Edge distance c _{cr,sp} [mm] for	2,0 > h/	$h_{ef} > 1,3$	4,6 · h _{ef} -	- 1,8 · h	1,3	-	
	h/h _{ef}	≤ 1,3	2,26	h_{ef}		1,0 h _{ef} 2,26 h _{ef}	C _{cr,sp}
Spacing	$s_{cr,sp}$	[mm]			$2 \cdot c_{cr,sp}$		

¹⁾ In absence of national regulations.

Performance

Essential characteristics under tension load in concrete

²⁾ No performance assessed.

Table C5: continued (1)

HZA / HZA-R				M12	M16	M20	M24	M27
Rebar diameter		φ	[mm]	12	16	20	25	28
Combined pullout and	d concrete con	e failure	for a worki	ng life of 5	0 years			
Characteristic resistance in hammer drilled holes a and diamond cored holes	and hammer dril	led holes	with Hilti ho			YD		
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	15	15	14	14	14
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	12	12	12	11	11
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	5,0	4,5	4,5	4,5	4,5
Characteristic resistance in diamond cored holes	e in uncracked	concrete	C20/25					
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	9,5	9,5	9,5	9,5	10
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	8,5	8,5	8,5	8,5	8,5
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	4,0	4,0	4,0	4,5	4,5
Characteristic resistance in hammer drilled holes a				es				
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	13	12	12	12	12
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	11	10	10	10	9,5
Temperature range III:	55°C / 75°C	$\tau_{Rk,ucr}$	$[N/mm^2]$	4,0	4,0	4,0	4,0	3,5
in hammer drilled holes a and diamond cored holes Temperature range I:						12	11	11
Temperature range II:	43°C / 55°C	$ au_{Rk,cr}$	[N/mm ²]	10	10	10	9,5	9,5
Temperature range III:		$ au_{Rk,cr}$	[N/mm ²]	4,0	4,0	3,5	3,5	3,5
Influence factors ψ or					· · · · · · · · · · · · · · · · · · ·		0,0	0,0
Influence of concrete st		ICC CRK II				<u>-</u>		
in hammer drilled holes a and diamond cored holes	and hammer dril	led holes	with Hilti ho	llow drill bit	ΓE-CD or TE-	YD		
Temperature range I to	III:	ψ_c	[-]			$(f_{ck}/20)^{0,1}$		
in diamond cored holes v	with roughening	with Hilti	Roughening	tool TE-YR	Ţ			
Temperature range I to	III:	ψ_c	[-]	1)		1	,0	
Influence of sustained le								
in hammer drilled holes a and diamond cored holes	s with roughenir	ng with Hil	ti Rougheni					
Temperature range I:	24°C / 40°C	ψ^0_{sus}	[-]			0,88		
Temperature range II:	43°C / 55°C	ψ_{sus}^0	[-]			0,72		
Temperature range III:	55°C / 75°C	ψ^0_{sus}	[-]			0,69		
in diamond cored holes	2490 / 4090	-4.0	r 1			0.00		
Temperature range I:	24°C / 40°C	ψ_{sus}^{0}	[-]			0,89		
Temperature range II:	43°C / 55°C	ψ_{sus}^0	[-]			0,70		
Temperature range III:	55°C / 75°C	ψ_{sus}^0	[-]			0,62		

Injection system	Hilti HIT-RE 500 V	4
------------------	--------------------	---

Performance

Essential characteristics under tension load in concrete

Table C5: continued (2)

				M12	M16	M20	M24	M27
Rebar diameter		φ	[mm]	12	16	20	25	28
Combined pullout and	d concrete cor	ne failure fo	or a worki	ng life of 1	00 years			
Characteristic resistand in hammer drilled holes a and diamond cored holes	and hammer dri	led holes w	ith Hilti ho			-YD		
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	15	15	14	14	14
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	12	12	12	11	11
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	5,0	4,5	4,5	4,5	4,5
Characteristic resistand in diamond cored holes	ce in uncracked	concrete C	20/25			_		
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	9,5	9,5	9,5	9,5	10
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	8,5	8,5	8,5	8,5	8,5
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	4,0	4,0	4,0	4,5	4,5
Characteristic resistance in hammer drilled holes a				es				_
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$		13	12	12	12	12
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	10	10	10	9,5	9,5
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	4,0	4,0	4,0	4,0	3,5
and diamond cored hole : Temperature range I:	24°C / 40°C		[N/mm ²]		I		0.0	l
remperature range i.	24 0 / 40 0				0.5			0.0
		,,		9.0	9,5 8.5	9,5 8.5	9,0 8.0	<u> </u>
Temperature range II:	43°C / 55°C	$ au_{Rk,100,cr}$	[N/mm ²]	9,0	8,5	8,5	8,0	8,0
Temperature range II: Temperature range III:	43°C / 55°C 55°C / 75°C	$ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$	[N/mm ²]	9,0	8,5 4,0	8,5 3,5	· '	8,0
Temperature range II: Temperature range III: Influence factors ψ or	43°C / 55°C 55°C / 75°C n bond resista	$ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$	[N/mm ²]	9,0	8,5 4,0	8,5 3,5	8,0	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored holes	43°C / 55°C 55°C / 75°C n bond resista trength and hammer drii	$ au_{Rk,100,cr} \ au_{Rk,100,cr} \ au_{Rk,100,cr}$	[N/mm ²] [N/mm ²] in cracke	9,0 4,0 ed and uncr	8,5 4,0 racked cond	8,5 3,5 crete	8,0	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored hole Temperature range I to	43°C / 55°C 55°C / 75°C n bond resista trength and hammer dril s	$ au_{Rk,100,cr} \ au_{Rk,100,cr} \ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ lled holes w ψ_c	[N/mm²] [N/mm²] in cracke ith Hilti ho	9,0 4,0 ed and uncr	8,5 4,0 racked cond	8,5 3,5 crete	8,0	9,0 8,0 3,5
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes a	43°C / 55°C 55°C / 75°C n bond resista trength and hammer drii s III: with roughening	$ au_{Rk,100,cr} \ au_{Rk,100,cr} \ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ lled holes w ψ_c	[N/mm²] [N/mm²] in cracke ith Hilti ho [-] oughening	9,0 4,0 ed and uncr llow drill bit1	8,5 4,0 racked cond	8,5 3,5 crete YD $(f_{ck}/20)^{0,1}$	8,0 3,5	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes Temperature range I to	43°C / 55°C 55°C / 75°C n bond resista trength and hammer dril s III: with roughening	$ au_{Rk,100,cr} \ au_{Rk,100,cr} \ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ lled holes w ψ_c	[N/mm²] [N/mm²] in cracke ith Hilti ho	9,0 4,0 ed and uncr	8,5 4,0 racked cond	8,5 3,5 crete YD $(f_{ck}/20)^{0,1}$	8,0	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes Temperature range I to Influence of sustained I	43°C / 55°C 55°C / 75°C n bond resista trength and hammer dril s III: with roughening	$ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ nce $ au_{Rk,100}$ lled holes w $ au_c$ g with Hilti R $ au_c$	[N/mm²] [N/mm²] in cracke ith Hilti ho [-] oughening [-]	9,0 4,0 ed and uncr fllow drill bit g tool TE-YR	8,5 4,0 racked cond TE-CD or TE-	8,5 3,5 crete YD $(f_{ck}/20)^{0,1}$	8,0 3,5	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes Temperature range I to Influence of sustained II in hammer drilled holes a and diamond cored holes	43°C / 55°C 55°C / 75°C n bond resista trength and hammer dril s III: with roughening and hammer dril soad and hammer dril s with rougheni	$ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ Ince $ au_{Rk,100}$ Illed holes w $ au_c$ Illed holes w $ au_c$ Illed holes w $ au_c$	[N/mm²] [N/mm²] in cracke ith Hilti ho [-] oughening [-] ith Hilti ho Rougheni	9,0 4,0 ed and uncr flow drill bit g tool TE-YR 1)	8,5 4,0 racked cond TE-CD or TE-	8,5 3,5 crete YD $(f_{ck}/20)^{0,1}$	8,0 3,5	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes Temperature range I to Influence of sustained I in hammer drilled holes a and diamond cored holes Temperature range I:	43°C / 55°C 55°C / 75°C n bond resista trength and hammer driis III: with roughening III: oad and hammer driis with rougheni s with rougheni	$ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ Illed holes w $ au_c$ Is with Hilti R $ au_c$ Illed holes w ing with Hilti $ au_{sus,100}$	[N/mm²] [N/mm²] in cracke ith Hilti ho [-] oughening [-] ith Hilti ho Rougheni	9,0 4,0 ed and uncr flow drill bit g tool TE-YR 1)	8,5 4,0 racked cond TE-CD or TE-	8,5 3,5 crete YD $(f_{ck}/20)^{0,1}$ 1 -YD 0,85	8,0 3,5	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes Temperature range I to Influence of sustained I in hammer drilled holes a and diamond cored holes Temperature range I:	43°C / 55°C 55°C / 75°C n bond resista trength and hammer dril s III: with roughening III: oad and hammer dril s with rougheni 24°C / 40°C 43°C / 55°C	$ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ Ince $ au_{Rk,100}$ Illed holes w $ au_c$ $ au_s$ $ au_{sus,100}$ $ au_{sus,100}$	[N/mm²] [N/mm²] in cracke ith Hilti ho [-] oughening [-] ith Hilti ho Rougheni	9,0 4,0 ed and uncr flow drill bit g tool TE-YR 1)	8,5 4,0 racked cond TE-CD or TE-	8,5 3,5 crete YD $(f_{ck}/20)^{0,1}$	8,0 3,5	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes Temperature range I to Influence of sustained II in hammer drilled holes a and diamond cored holes Temperature range I: Temperature range II: Temperature range III:	43°C / 55°C 55°C / 75°C n bond resista trength and hammer driis III: with roughening III: oad and hammer driis with rougheni s with rougheni	$ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ Illed holes w $ au_c$ Is with Hilti R $ au_c$ Illed holes w ing with Hilti $ au_{sus,100}$	[N/mm²] [N/mm²] in cracke ith Hilti ho [-] oughening [-] ith Hilti ho Rougheni	9,0 4,0 ed and uncr flow drill bit g tool TE-YR 1)	8,5 4,0 racked cond TE-CD or TE-	8,5 3,5 crete YD $(f_{ck}/20)^{0,1}$ 1 -YD 0,85	8,0 3,5	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes Temperature range I to Influence of sustained I in hammer drilled holes a and diamond cored holes Temperature range I: Temperature range II: Temperature range III: Temperature range III: in diamond cored holes	43°C / 55°C 55°C / 75°C n bond resista trength and hammer drii s III: with roughening III: load and hammer drii s with rougheni 24°C / 40°C 43°C / 55°C 55°C / 75°C	$ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ Ince $ au_{Rk,100}$ Illed holes w $ au_c$ Is with Hilti R $ au_c$ Illed holes w $ au_c$ Ince the sum of the su	[N/mm²] [N/mm²] in cracke ith Hilti ho [-] oughening [-] ith Hilti ho Rougheni [-] [-]	9,0 4,0 ed and uncr flow drill bit g tool TE-YR 1)	8,5 4,0 racked cond TE-CD or TE-	8,5 3,5 crete YD	8,0 3,5	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a and diamond cored holes Temperature range I to in diamond cored holes Temperature range I to Influence of sustained II in hammer drilled holes a and diamond cored holes Temperature range I: Temperature range II: Temperature range III: in diamond cored holes Temperature range III:	43°C / 55°C 55°C / 75°C n bond resista trength and hammer dril s III: with roughening III: oad and hammer dril s with rougheni 24°C / 40°C 43°C / 55°C 55°C / 75°C	$ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ Ince $ au_{Rk,100}$ Illed holes w $ au_c$ Illed holes w In the sum of th	[N/mm²] [N/mm²] in cracke ith Hilti ho [-] oughening [-] ith Hilti ho Rougheni [-] [-]	9,0 4,0 ed and uncr flow drill bit g tool TE-YR 1)	8,5 4,0 racked cond TE-CD or TE-	8,5 3,5 crete YD $(f_{ck}/20)^{0,1}$ 1 -YD $0,85$ 0,72 0,69 $0,70$	8,0 3,5	8,0
Temperature range II: Temperature range III: Influence factors ψ or Influence of concrete st in hammer drilled holes a	43°C / 55°C 55°C / 75°C n bond resista trength and hammer drii s III: with roughening III: load and hammer drii s with rougheni 24°C / 40°C 43°C / 55°C 55°C / 75°C	$ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ $ au_{Rk,100,cr}$ Ince $ au_{Rk,100}$ Illed holes w $ au_c$ Is with Hilti R $ au_c$ Illed holes w $ au_c$ Ince the sum of the su	[N/mm²] [N/mm²] in cracke ith Hilti ho [-] oughening [-] ith Hilti ho Rougheni [-] [-]	9,0 4,0 ed and uncr llow drill bit 1 g tool TE-YR 1)	8,5 4,0 racked cond TE-CD or TE-	8,5 3,5 crete YD	8,0 3,5	8,0

¹⁾ No performance assessed.

Injection system Hilti HIT-RE 500 V4

Performance

Essential characteristics under tension load in concrete

Table C6: Essential characteristics for reinforcing bars (rebars) under tension load in concrete

Reinforcing bar (rebar)			φ8	φ10	φ12	φ14	φ16	φ18	φ20	φ24	φ25	φ28	φ30	φ32
For a working life of 50 and 100 year	rs								•	•	•			
Steel failure														
Characteristic resistance	$N_{Rk,s}$	[kN]						A_s .	f_{uk}^{-1}					
Characteristic resistance Rebar B500B acc. to DIN 488 ²⁾	$N_{Rk,s}$	[kN]	28	43	62	85	111	140	173	249	270	339	389	442
Partial factor Rebar B500B acc. to DIN 488 3)	$\gamma_{Ms,N}^{4}$) [-]						1	,4					
Installation factor														
Hammer drilling	γ_{inst}	[-]						1	,0					
Hammer drilling with Hilti hollow drill bit TE-CD or TE-YD	γ_{inst}	[-]						1	,0					
Diamond coring	γ_{inst}	[-]		1	,2					1	,4			
Diamond coring with roughening with Hilti Roughening tool TE-YRT	γ_{inst}	[-]		5)					1,0				5	5)
Hammer drilling in water-filled drill holes	γ_{inst}	[-]						1	,4					
Concrete cone failure														
Factor for cracked concrete	$k_{cr,N}$	[-]						7	,7					
Factor for uncracked concrete	$k_{ucr,N}$	[-]						11	1,0					
Edge distance	$c_{cr,N}$	[mm]						1,5 ·	hef					
Spacing	$s_{cr,N}$	[mm]						3,0 ·	hef					
Splitting failure														
		$h/h_{ef} \ge 2.0$		1,0	$) \cdot h_{ef}$			h/h _{ef} 2,0						
Edge distance c _{cr,sp} [mm] for	2,0 >	$h/h_{ef} > 1,3$	4,	,6 · h _e	f - 1	,8 · h		1,3 ·						
		$h/h_{ef} \le 1,3$		2,2	$6 \cdot h_{ej}$	f				1,0 h _{ef}	2,26	h _{ef}	→ C _{cr,s}	;p
Spacing	$s_{cr,sp}$	[mm]						$2 \cdot c$	cr,sp					

Performance

Essential characteristics under tension load in concrete

Table C6: continued (1)

Reinforcing bar (rebar	r)			φ8	φ10	φ12	φ14	φ16	φ18	φ20	φ24	φ25	φ28	φ30	φ32
Combined pullout and	concrete con	e failure	for a work	ing I	ife of	50 y	ears								
Characteristic resistance in hammer drilled holes a and diamond cored holes	and hammer drill	ed holes	with Hilti ho				CD o	r TE-Y	'D						
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	10	15	15	15	15	14	14	14	14	14	13	13
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	8,5	13	12	12	12	12	12	12	11	11	11	11
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	3,5	5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5
Characteristic resistance in diamond cored holes	e in uncracked	concrete	C20/25												
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	9,5	9,5	9,5	9,5	9,5	9,5	9,5	9,5	9,5	10	10	10
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	9,0	9,0
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,5	4,5	4,5	4,5	4,5
Characteristic resistance in hammer drilled holes a				les											
Temperature range I:	24°C / 40°C	$ au_{Rk,ucr}$	[N/mm ²]	8,5	13	13	13	12	12	12	12	12	12	11	11
Temperature range II:	43°C / 55°C	$ au_{Rk,ucr}$	[N/mm ²]	7,0	11	11	10	10	10	10	10	10	9,5	9,5	9,5
Temperature range III:	55°C / 75°C	$ au_{Rk,ucr}$	[N/mm ²]	3,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	3,5	3,5	3,5
and diamond cored holes Temperature range I: Temperature range II: Temperature range III:	24°C / 40°C 43°C / 55°C 55°C / 75°C	$ au_{Rk,cr}$ $ au_{Rk,cr}$ $ au_{Rk,cr}$	[N/mm ²] [N/mm ²] [N/mm ²]	5,5	10 8,5 4,0	12 10 4,0	12 10 4.0	12 10 4.0	12 10 4.0	12 10 3.5	11 9,5 3,5	11 9,5 3.5	11 9,5 3,5	11 9,5 3,5	11 9,0 3,5
Influence factors ψ or		-,-					, -	, -	, -	3,3	3,3	3,3	3,3	3,3	3,3
Influence of concrete st		icc t _{Rk} iii	- Crackea	una (111010	ORCO		OI CLC							
in hammer drilled holes a and diamond cored holes	and hammer drill	led holes v	with Hilti ho	llow	drill b	itTE-0	CD or	TE-Y	D						
Temperature range I to		ψ_c	[-]						$(f_{ck}/2)$	20) ^{0,1}					
in diamond cored holes v				g too	I TE-Y	'RT	1							_	-\
Temperature range I to		ψ_c	[-]		5)					1,0				5	5)
Influence of sustained le					.1	T-		. TE `	<u></u>						
in hammer drilled holes a and diamond cored holes	s with roughenin	ng with Hil	ti Roughen					IE-Y							
Temperature range I:	24°C / 40°C	ψ^0_{sus}	[-]							88					
Temperature range II:	43°C / 55°C	ψ_{sus}^0	[-]							72					
Temperature range III:	55°C / 75°C	ψ_{sus}^0	[-]						0,	69					
in diamond cored holes	0400 / 4000	. 0													
Temperature range I:	24°C / 40°C	ψ_{sus}^0	[-]							89					
Temperature range II: Temperature range III:	43°C / 55°C 55°C / 75°C	$\psi^0_{sus} \ \psi^0_{sus}$	[- <u>]</u> [-]							70 62					
Lamparatura ranga III.															

Performance

Essential characteristics under tension load in concrete

Table C6: continued (2)

Reinforcing bar (rebar	.)			φ8	φ10	φ12	φ14	φ16	φ18	φ20	φ24	φ25	φ28	φ30	φ32
Combined pullout and		ne failure f	or a work				_	_	-		-				
Characteristic resistanc in hammer drilled hole and diamond cored ho	e in uncracked s and hamme	concrete (C20/25 cles with	Hilti	hollo	w dri	ill bit	TE-C	D or	TE-Y	/D				
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	10	15	15	15	15	14	14	14	14	14	13	13
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	8,0	12	12	12	12	12	12	11	11	11	11	11
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	3,0	5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5
Characteristic resistanc in diamond cored hole		concrete (C20/25												
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	9,5	9,5	9,5	9,5	9,5	9,5	9,5	9,5	9,5	10	10	10
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	9,0	9,0
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,5	4,5	4,5	4,5	4,5
Characteristic resistanc in hammer drilled hole				drill l	noles										
Temperature range I:	24°C / 40°C	$ au_{Rk,100,ucr}$	[N/mm ²]	8,5	13	13	13	12	12	12	12	12	12	11	11
Temperature range II:	43°C / 55°C	$ au_{Rk,100,ucr}$	[N/mm ²]	7,0	11	10	10	10	10	10	9,5	9,5	9,5	9,5	9,0
Temperature range III:	55°C / 75°C	$ au_{Rk,100,ucr}$	[N/mm ²]	2,5	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	3,5	3,5	3,5
Temperature range II: Temperature range III:	24°C / 40°C 43°C / 55°C		[N/mm ²] [N/mm ²]	4,5	9,0 8,0	9,0	9,0	9,5 8,5	9,5 8,5	9,5 8,5		9,0 8,0	9,0 8,0	9,0 8,0	9,0 8,0
Temperature range III: Influence factors ψ on			[N/mm ²]	2,0	4,0	4,0	4,0	4,0	4,0	3,5	3,5	3,5	3,5	3,5	3,5
Influence of concrete st		$\iota_{Rk,100}$	III CIACK	eu ai	iu uii	Claci	NGU U	OHICI	CIC						
in hammer drilled hole and diamond cored ho	s and hamme	r drilled h	oles with	Hilti	hollo	w dri	ill bit								
Temperature range I to		ψ_c	[-]						$(f_{ck})^2$	$(20)^{0,1}$					
in diamond cored hole				T		ool T	E-YR	Τ							-\
Temperature range I to		ψ_c	[-]	1	5)					1,0					5)
Influence of sustained lo		و ما المماليون	alaa with	LI;14;	halla	امر حادا		TE C	ים מי	TEN	<u>/D</u>				
in hammer drilled hole and diamond cored ho	les with roug	hening wit	h Hilti Ro	ough							טו				
Temperature range I:	24°C / 40°C	$\psi^0_{sus,100}$	[-]							85					
Temperature range II:	43°C / 55°C	$\psi^0_{sus,100}$		[-] 0,72											
Temperature range III:	55°C / 75°C	$\psi^0_{sus,100}$	[-]						0,	69					
in diamond cored hole				1											
Temperature range I:	24°C / 40°C	$\psi^0_{sus,100}$	[-]	_						70					
Temperature range II:	43°C / 55°C	$\psi^0_{sus,100}$	[-]							67					
Temperature range III:	55°C / 75°C	$\psi^0_{sus,100}$													

 f_{uk} according to rebar specification.

Injection system Hilti HIT-RE 500 V4

Performance

Essential characteristics under tension load in concrete

²⁾

Values need to be calculated acc. EAD 330499-02, Eq. 2.1, if rebars do not fulfil the requirements acc. DIN 488. Values need to be calculated acc. EN 1992-4:2018, tab 4.1, if rebars do not fulfil the requirements acc. DIN 488. 3)

⁴⁾ In absence of national regulations.

No performance assessed.

Table C7: Essential characteristics for metric threaded rod according to Annex A under shear load in concrete

Metric threaded rod according to Ar	nnex A		M8	M10	M12	M16	M20	M24	M27	M30	
For a working life of 50 and 100 year	rs										
Steel failure without lever arm											
Characteristic resistance	$V_{Rk,s}^0$	[kN]				$k_6 \cdot A$	$s \cdot f_{uk}$				
Factor grade 5.8	k ₆	[-]	0,6								
Factor grade 6.8, 8.8	k_6	[-]				0	,5				
Factor HAS A4, HAS-U A4, HIT-V-R, Threaded rod: CRC II and III (Table A2)	k ₆	[-]	0,5								
Factor HAS-U HCR, HIT-V-HCR, Threaded rod: CRC V (Table A2)	k ₆	[-]				0	,5				
Partial factor grade 5.8, 6.8, 8.8	$\gamma_{Ms,V}^{-1)}$	[-]				1,	25				
Partial factor Factor HAS A4, HAS-U A4, HIT-V-R, Threaded rod: CRC II and III (Table A2)	$\gamma_{Ms,V}$ 1)	[-]			1,	56			2,38		
Partial factor HAS-U HCR, HIT-V-HCR, Threaded rod: CRC V (Table A2)	$\gamma_{Ms,V}$ 1)	[-]			1,25				1,75		
Ductility factor	k ₇	[-]				1	,0	_			
Steel failure with lever arm											
Characteristic resistance	$M_{Rk,s}^0$	[Nm]				1,2 · W	$f_{el} \cdot f_{uk}$				
Ductility factor	k ₇	[-]				1	,0				
Concrete pry-out failure											
Pry-out factor	k_8	[-]				2	,0				
Concrete edge failure											
Effective length of fastener	l_f	[mm]	$\min[h_{ef}; 12 \cdot d_{nom}]$ $\min[hef] \cdot d_{nom}; 3$								
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	16	20	24	27	30	

¹⁾ In absence of national regulations.

Injection system Hilti HIT-RE 500 V4	
Performance Essential characteristics under shear load in concrete	Annex C19

Table C8: Essential characteristics for fractional threaded rod according to Annex A under shear load in concrete

Fractional threaded rod accordi	ng to Annex A	[in.]	3/8	1/2	5/8	3/4	7/8	1	1 1/4
For a working life of 50 and 100	years	•			•				•
Steel failure without lever arm									
Characteristic resistance	$V^0_{Rk,s}$	[kN]			k	$z_6 \cdot A_s \cdot f_u$	k		
Factor HIT-V	k_6	[-]				0,6			
Factor HAS-E-36	k_6	[-]				0,6			
Factor HAS-E-55	k_6	[-]				0,5			
Factor HAS-B-105	k_6	[-]				0,5			
Factor HAS-R 304	k_6	[-]				0,5			
Factor HAS-R 316	k_6	[-]				0,5			
Partial factor HIT-V	$\gamma_{Ms,V}$ 1)	[-]				1,60			
Partial factor HAS-E-36	$\gamma_{Ms,V}$ 1)	[-]				1,61			
Partial factor HAS-E-55	$\gamma_{Ms,V}$ 1)	[-]				1,36			
Partial factor HAS-B-105	$\gamma_{Ms,V}$ 1)	[-]				1,50			
Partial factor HAS-R 304	$\gamma_{Ms,V}$ 1)	[-]		1,54			1,89		2,51
Partial factor HAS-R 316	$\gamma_{Ms,V}$ 1)	[-]		1,54			1,	89	
Ductility factor	k_7	[-]				1,0			
Steel failure with lever arm									
Characteristic resistance	$M_{Rk,s}^0$	[Nm]			1,	$2 \cdot W_{el} \cdot f$	uk		
Ductility factor	k_7	[-]				1,0			
Concrete pry-out failure		•							
Pry-out factor	k_8	[-]	[-] 2,0						
Concrete edge failure									
Effective length of fastener	l_f	[mm]							nef; 8 ₁ ; 300)
Outside diameter of fastener	d_{nom}	[mm]	9,5	12,7	15,9	19,1	22,2	25,4	31,8

¹⁾ In absence of national regulations.

Performance

Essential characteristics under shear load in concrete

Table C9: Essential characteristics for internally threaded sleeve HIS-(R)N under shear load in concrete

HIS-(R)N			M8	M10	M12	M16	M20
For a working life of 50 and 100 years	ears						
Steel failure without lever arm							
Characteristic resistance	$V_{Rk,s}^0$	[kN]	13	23	34	63	58
Partial factor	$\gamma_{Ms,V}^{1)}$	[-]			1,25		
Characteristic resistance HIS-RN with screw grade 70	$V_{Rk,s}^0$	[kN]	13	20	30	55	83
Partial factor	$\gamma_{Ms,V}^{1)}$	[-]		1,	56		2,0
Ductility factor	k_7	[-]			1,0		
Steel failure with lever arm							
Characteristic resistance HIS-N	$M_{Rk,s}^0$	[Nm]	30	60	105	266	519
Characteristic resistance HIS-RN	$M_{Rk,s}^0$	[Nm]	26	52	92	233	454
Ductility factor	k ₇	[-]			1,0		
Concrete pry-out failure							
Pry-out factor	k_8	[-]			2,0		
Concrete edge failure							
Effective length of fastener	l_f	[mm]	90	110	125	170	205
Outside diameter of fastener	d_{nom}	[mm]	12,5	16,5	20,5	25,4	27,6

¹⁾ In absence of national regulations.

Performance

Essential characteristics under shear load in concrete

Table C10: Essential characteristics for internally threaded sleeve HIS-(R)N under shear load in concrete

HIS-(R)N, size		[in.]	3/8	1/2	5/8	3/4
For a working life of 50 and 100 year	s					
Steel failure without lever arm						
Characteristic resistance HIS-N Screw acc. to SAE J429 Grade 5 or ASTM A325 (1/2 in. to 3/4 in.)	$V_{Rk,s}^0$	[kN]	21	38	60	65
Partial factor	$\gamma_{Ms,V}$ 1)	[-]		1,50		1,25
Characteristic resistance HIS-N Screw acc. to ASTM A193 Grade B7	$V_{Rk,s}^0$	[kN]	22	40	63	65
Partial factor	$\gamma_{Ms,V}$ 1)	[-]		1,50		1,25
Characteristic resistance HIS-RN Screw acc. to ASTM A193 Grade B8M (AISI 316)	$V_{Rk,s}^0$	[kN]	19	35	55	93
Partial factor	$\gamma_{Ms,V}$ 1)	[-]		1,50		2,00
Characteristic resistance HIS-RN Screw acc. to ASTM A193 Grade B8T (AISI 321)	$V_{Rk,s}^0$	[kN]	22	40	63	93
Partial factor	$\gamma_{Ms,V}$ 1)	[-]		1,50		2,00
Ductility factor	k_7	[-]		1,	0	
Steel failure with lever arm						
Characteristic resistance HIS-N Screw acc. to SAE J429 Grade 5 or ASTM A325 (1/2 in. to 3/4 in.)	$M_{Rk,s}^0$	[Nm]	50	123	247	444
Characteristic resistance HIS-N Screw acc. to ASTM A193 Grade B7	$M_{Rk,s}^0$	[Nm]	52	128	257	463
Characteristic resistance HIS-RN Screw acc. to ASTM A193 Grade B8M (AISI 316)	$M_{Rk,s}^0$	[Nm	45	113	226	407
Characteristic resistance HIS-RN Screw acc. to ASTM A193 Grade B8T (AISI 321)	$M_{Rk,s}^0$	[Nm]	52	128	257	463
Ductility factor	k_7	[-]		1,	0	
Concrete pry-out failure						
Pry-out factor	k_8	[-]		2,	0	
Concrete edge failure						
Effective length of fastener	l_f	[mm]	110	125	170	205
Outside diameter of fastener	d_{nom}	[mm]	16,5	20,5	25,4	27,6

¹⁾ In absence of national regulations.

Performance

Essential characteristics under shear load in concrete

Table C11: Essential characteristics for Hilti Tension anchor HZA / HZA-R under shear load in concrete

HZA / HZA-R			M12	M16	M20	M24	M27
Rebar diameter	φ	[mm]	12	16	20	25	28
For a working life of 50 and 100 y	ears						
Steel failure without lever arm							
Characteristic resistance HZA	$V_{Rk,s}^0$	[kN]	23	43	67	97	126
Characteristic resistance HZA-R	$V_{Rk,s}^0$	[kN]	31	55	86	124	2)
Partial factor	$\gamma_{Ms,V}$ 1)	[-]			1,5		
Ductility factor	k ₇	[-]			1,0		
Steel failure with lever arm							
Characteristic resistance HZA	$M_{Rk,s}^0$	[Nm]	72	183	357	617	915
Characteristic resistance HZA-R	$M_{Rk,s}^0$	[Nm]	97	234	457	790	2)
Ductility factor	k ₇	[-]			1,0		
Concrete pry-out failure							
Pry-out factor	k ₈	[-]			2,0		
Concrete edge failure							
Effective length of fastener	l_f	[mm]	$\min(h_{ef}; 12 \cdot d_{nom}) \qquad \min(hef; d_{nom}; 30)$				
Outside diameter of fastener	d_{nom}	[mm]	12	16	20	24	27

¹⁾ In absence of national regulations.

Performance

Essential characteristics under shear load in concrete

²⁾ No performance assessed.

Table C12: Essential characteristics for reinforcing bars (rebars) under shear load in concrete

Reinforcing bar (rebar)			φ8	φ10	φ12	φ14	φ16	φ18	φ20	φ24	φ25	φ28	φ30	φ32
For a working life of 50 and 100 y	ears/													
Steel failure without lever arm														
Characteristic resistance	$V_{Rk,s}^0$	[kN]						0,5 ·	$A_s \cdot f_u$	k 1)				
Characteristic resistance Rebar B500B acc. to DIN 488 ²⁾	$V_{Rk,s}^0$	[kN]	14	22	31	42	55	70	86	124	135	169	194	221
Partial factor Rebar B500B acc. to DIN 488 3)	$\gamma_{Ms,V}^{4)}$	[-]							1,5					
Ductility factor	k_7	[-]							1,0					
Steel failure with lever arm														
Characteristic resistance	$M_{Rk,s}^0$	[Nm]						1,2 · 1	$N_{el} \cdot f_u$	1) ık				
Characteristic resistance Rebar B500B acc. to DIN 488	$M_{Rk,s}^0$	[Nm]	33	65	112	178	265	378	518	896	1012	1422	1749	2123
Ductility factor	k_7	[-]							1,0					
Concrete pry-out failure														
Pry-out factor	k_8	[-]							2,0					
Concrete edge failure														
Effective length of fastener	l_f	[mm]			mi	$n(h_{ef};$	12 · d	nom)			min(/	nef; 8	d_{nom} ;	300)
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	14	16	18	20	24	25	28	30	32

Injection system	Hilti HIT-RE 500 V4
------------------	---------------------

Performance

Essential characteristics under shear load in concrete

 f_{uk} according to rebar specification. Values need to be calculated acc. EAD 330499-02, Eq. 2.1, if rebars do not fulfil the requirements acc. DIN 488. Values need to be calculated acc. EN 1992-4:2018, tab 4.1, if rebars do not fulfil the requirements acc. DIN 488. 2) 3)

In absence of national regulations.

Table C13: Displacements for threaded rod under tension load in concrete

Threaded rod, HAS-U, H	IIT-V,	АМ	.8.8	М8	M10	M12	M16	M20	M24	M27	M30
Threaded rod, HAS, HIT	[in.]	-	3/8	1/2	5/8	3/4	7/8	1	1 1/4		
Displacement in uncracked	l concret	e									
Temperature range I: 24°C	· / 40°C -	δ_{N0}	$[mm/(N/mm^2)]$	0,04	0,05	0,05	0,06	0,06	0,07	0,08	0,08
Temperature range i. 24 C	7 40 C =	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,10	0,11	0,12	0,13	0,15	0,17	0,18	0,19
Temperature range II: 43°C	/ FE°C -	δ_{N0}	$[mm/(N/mm^2)]$	0,05	0,05	0,06	0,07	0,07	0,08	0,09	0,10
Temperature range II. 43 C	/ 55 C =	$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,14	0,16	0,18	0,20	0,21	0,23
Temperature range III: 55°C / 75°C	/ 75°C	δ_{N0}	[mm/(N/mm²)]	0,05	0,06	0,06	0,07	0,08	0,09	0,09	0,10
Temperature range III. 55 C	. / /3 C -	$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,15	0,17	0,19	0,21	0,23	0,24
Displacement in cracked co	oncrete										
Temperature range I: 24°C	· / 40°C =	δ_{N0}	$[mm/(N/mm^2)]$	0,02	0,03	0,05	0,08	0,10	0,13	0,15	0,18
Temperature range i. 24 C	7 40 C =	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,12	0,19	0,14	0,19	0,16	0,16	0,15	0,18
Tomporature renge II. 42°C	/ 5500	δ_{N0}	[mm/(N/mm²)]	0,02	0,04	0,06	0,09	0,12	0,16	0,18	0,21
Temperature range II: 43°C	. / 55 C =	$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,23	0,17	0,23	0,19	0,19	0,18	0,21
Temperature range III: 55°C	/ 75°C	δ_{N0}	[mm/(N/mm²)]	0,02	0,04	0,06	0,10	0,13	0,17	0,19	0,22
remperature range III. 55 C		$\delta_{N\infty}$	[mm/(N/mm²)]	0,16	0,24	0,18	0,24	0,20	0,20	0,19	0,22

Table C14: Displacements for internally threaded HIS-(R)N under tension load in concrete

HIS-(R)N			M8	M10	M12	M16	M20
HIS-(R)N, size		[in.]	-	3/8	1/2	5/8	3/4
Displacement in uncracked conc	rete						
Temperature range I: 24°C / 40°C	δ_{N0}	[mm/(N/mm²)]	0,05	0,06	0,06	0,07	0,08
Temperature range 1. 24 C / 40 C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,15	0,17	0,18
Temperature range II: 43°C / 55°C	δ_{No}	[mm/(N/mm²)]	0,06	0,07	0,07	0,08	0,09
remperature range ii. 43 C / 55 C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,14	0,16	0,18	0,20	0,21
Temperature range III: 55°C / 75°C	δ_{N0}	[mm/(N/mm²)]	0,06	0,07	0,07	0,09	0,10
remperature range iii. 55 C / 75 C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,16	0,19	0,21	0,22
Displacement in cracked concret	е						
Temperature range I: 24°C / 40°C	δ_{N0}	[mm/(N/mm²)]	0,02	0,03	0,05	0,08	0,10
Temperature range i. 24 C / 40 C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,19	0,14	0,19	0,16
Tomporature range II. 429C / FF90	δ_{N0}	[mm/(N/mm²)]	0,02	0,04	0,06	0,09	0,12
Temperature range II: 43°C / 55°C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,23	0,17	0,23	0,19
Temperature range III. FEGO / 7500	δ_{N0}	[mm/(N/mm²)]	0,02	0,04	0,06	0,10	0,13
Temperature range III: 55°C / 75°C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,16	0,24	0,18	0,24	0,20

Performance

Displacements under tension load in concrete

Table C15: Displacements for Hilti Tension anchor HZA / HZA-R under tension load in concrete

HZA / HZA-R			M12	M16	M20	M24	M27
Rebar diameter	φ	[mm]	12	16	20	25	28
Displacement in uncracked concre	te						
Temperature range I: 24°C / 40°C	δ_{N0}	$[mm/(N/mm^2)]$	0,05	0,06	0,07	0,07	0,08
Temperature range i. 24 C / 40 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,12	0,15	0,17	0,18	0,19
Temperature range II: 43°C / 55°C	δ_{N0}	$[mm/(N/mm^2)]$	0,06	0,07	0,09	0,09	0,09
Temperature range II. 43 C / 55 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,14	0,18	0,20	0,21	0,22
Temperature range III: 55°C / 75°C	δ_{N0}	$[mm/(N/mm^2)]$	0,07	0,08	0,09	0,09	0,10
Temperature range III. 55 C / 75 C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,19	0,22	0,22	0,23
Displacement in cracked concrete							
Temperature range I: 24°C / 40°C	δ_{N0}	$[mm/(N/mm^2)]$	0,06	0,10	0,14	0,15	0,16
Temperature range i. 24 C / 40 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,06	0,16	0,16	0,15	0,16
Temperature range II: 43°C / 55°C	δ_{N0}	$[mm/(N/mm^2)]$	0,07	0,12	0,17	0,17	0,19
Temperature range II. 43 C / 55 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,07	0,19	0,19	0,18	0,19
Temperature range III: 55°C / 75°C	δ_{N0}	$[mm/(N/mm^2)]$	0,08	0,13	0,17	0,18	0,20
Temperature range III. 55 C / 75 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,08	0,20	0,20	0,19	0,20

Table C16: Displacements for reinforcing bar (rebar) under tension load in concrete

Reinforcing bar (rebar)			φ8	φ10	φ12	φ14	φ16	φ18
Displacement in uncracked concre	ete							
Temperature range I: 24°C / 40°C	δ_{N0}	$[mm/(N/mm^2)]$	0,04	0,05	0,05	0,06	0,06	0,07
Temperature range i. 24 C / 40 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,10	0,11	0,12	0,13	0,15	0,16
Temperature range II: 43°C / 55°C	δ_{N0}	$[mm/(N/mm^2)]$	0,05	0,05	0,06	0,07	0,07	0,08
Temperature range ii. 43 C / 55 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,12	0,13	0,14	0,16	0,18	0,19
Tomporoture range III. FEOC / 750C	δ_{N0}	$[mm/(N/mm^2)]$	0,05	0,06	0,07	0,07	0,08	0,08
Temperature range III: 55°C / 75°C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,12	0,13	0,15	0,17	0,19	0,21
Displacement in cracked concrete								
Temperature range I: 24°C / 40°C	δ_{N0}	$[mm/(N/mm^2)]$	0,02	0,03	0,06	0,08	0,10	0,11
Temperature range i. 24 C / 40 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,12	0,19	0,06	0,19	0,16	0,16
Temperature range II: 43°C / 55°C	δ_{N0}	[mm/(N/mm²)]	0,02	0,04	0,07	0,09	0,12	0,14
Temperature range II. 43 C / 55 C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,23	0,07	0,23	0,19	0,19
Tomporature range III: 55°C / 75°C	δ_{N0}	[mm/(N/mm²)]	0,02	0,04	0,08	0,10	0,13	0,14
Temperature range III: 55°C / 75°C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,16	0,24	0,08	0,24	0,20	0,20

Performance

Displacements under tension load in concrete

Table C17: Displacements for reinforcing bar (rebar) under tension load in concrete

Reinforcing bar (rebar)			φ20	φ24	φ25	φ28	φ30	φ32
Displacement in uncracked concre	ete							
Temperature range I: 24°C / 40°C	δ_{N0}	[mm/(N/mm²)]	0,07	0,07	0,07	0,08	0,08	0,08
Temperature range i. 24 C / 40 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,17	0,19	0,18	0,19	0,19	0,20
Temperature range II: 43°C / 55°C	δ_{N0}	$[mm/(N/mm^2)]$	0,09	0,08	0,09	0,09	0,10	0,10
Temperature range ii. 43 C / 55 C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,20	0,21	0,21	0,22	0,23	0,24
Temperature range III: 55°C / 75°C	δ_{N0}	[mm/(N/mm²)]	0,09	0,09	0,09	0,10	0,10	0,11
Temperature range III. 55 C / 75 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,22	0,22	0,22	0,23	0,24	0,25
Displacement in cracked concrete								
Temperature range I: 24°C / 40°C	δ_{N0}	$[mm/(N/mm^2)]$	0,14	0,15	0,15	0,16	0,18	0,19
Temperature range i. 24 C7 40 C	$\delta_{N\infty}$	$[mm/(N/mm^2)]$	0,16	0,16	0,15	0,16	0,18	0,19
Temperature range II: 43°C / 55°C	δ_{N0}	$[mm/(N/mm^2)]$	0,17	0,17	0,17	0,19	0,21	0,22
Temperature range II. 43 C / 55 C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,19	0,19	0,18	0,19	0,21	0,22
Tomporature range III: F5°C / 75°C	δ_{N0}	[mm/(N/mm²)]	0,17	0,18	0,18	0,20	0,22	0,24
Temperature range III: 55°C / 75°C	$\delta_{N\infty}$	[mm/(N/mm²)]	0,20	0,20	0,19	0,20	0,22	0,24

Performance

Displacements under tension load in concrete

Table C18: Displacements for threaded rod under shear load in concrete

Metric threaded rod according to Annex A			M8	M10	M12	M16	M20	M24	M27	M30
Fractional threaded rod according to Annex A [in.]		ı	3/8	1/2	5/8	3/4	7/8	1	1 1/4	
Diamlasament	δ_{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

Table C19: Displacements for internally threaded HIS-(R)N under shear load in concrete

HIS-(R)N			М8	M10	M12	M16	M20
HIS-(R)N, size		[in.]	-	3/8	1/2	5/8	3/4
Displacement	δ_{V0}	[mm/kN]	0,06	0,06	0,05	0,04	0,04
Displacement	$\delta_{\scriptscriptstyle m Vm}$	[mm/kN]	0,09	0,08	0.08	0,06	0,06

Table C20: Displacements for Hilti Tension anchor HZA / HZA-R under shear load in concrete

HZA / HZA-R			M12	M16	M20	M24	M27
Displacement	δ_{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

Table C21: Displacements for reinforcing bar (rebar) under shear load in concrete

Reinforcing bar (rebar)			φ10	φ12	φ14	φ16	φ18	φ20
Displacement	δ_{V0}	[mm/kN]	0,05	0,05	0,05	0,04	0,04	0,04
Displacement	$\delta_{V^{\infty}}$	[mm/kN]	0,08	0,08	0,07	0,06	0,06	0,06

Table C22: Displacements for reinforcing bar (rebar) under shear load in concrete

Reinforcing bar (rebar)			φ24	φ25	φ28	φ30	φ32	φ24
Dianlagement	δ_{V0}	[mm/kN]	0,04	0,03	0,03	0,03	0,03	0,03
Displacement	$\delta_{V\infty}$	[mm/kN]	0,05	0,05	0,05	0,05	0,04	0,04

Injection system Hilti HIT-RE 500 V4

Performance

Displacements under shear load in concrete

Table C23: Essential characteristics for metric threaded rod according Annex A under tension load for seismic category C1 in concrete

Metric threaded rod acco	Metric threaded rod according to Annex A					M12	M16	M20	M24	M27	M30	
For a working life of 50 a	ınd 100 year	rs										
Steel failure												
Characteristic resistance		$N_{Rk,s,C1}$	[kN]				A_s ·	f_{uk}				
Combined pullout and co	or a worki	ng life	of 50 ye	ears								
Characteristic 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: 2	4°C / 40°C	$ au_{Rk,C1}$	$[N/mm^2]$	6,8	8,2	10,1	10,5	9,7	9,4	9,0	8,5	
Temperature range II: 4	3°C / 55°C	$ au_{Rk,C1}$	$[N/mm^2]$	6,3	7,3	8,3	8,1	7,8	7,9	7,5	7,0	
Temperature range III: 5	5°C / 75°C	$ au_{Rk,C1}$	[N/mm ²]	3,6	3,2	3,2	3,3	2,9	3,0	3,0	3,0	
Combined pullout and co	oncrete con	e failure fo	or a worki	ing life	of 100 y	/ears						
Characteristic resistance in hammer drilled holes and and diamond cored holes w	hammer drill	led holes w	ith Hilti ho			CD or TE	-YD					
Temperature range I: 2	4°C / 40°C	$ au_{Rk,100,C1}$	[N/mm²]	6,3	7,3	8,3	8,1	7,8	7,4	7,0	6,5	
Temperature range II: 4	3°C / 55°C	$ au_{Rk,100,C1}$	[N/mm²]	5,4	6,4	7,4	7,1	6,8	6,4	6,5	6,0	
Temperature range III: 5	5°C / 75°C	$ au_{Rk,100,C1}$	[N/mm²]	3,6	3,2	3,2	3,3	2,9	3,0	3,0	3,0	
Influence factors ψ on be	ond resistar				•							
Influence of concrete stren	ngth	-	-									
Temperature range I to III:		ψ_c	[-]				1,	,0				

Table C24: Essential characteristics for fractional threaded rod according Annex A under tension load for seismic category C1 in concrete

Fractional threaded rod ac	ractional threaded rod according to Annex A [in.] 3/8 1/2 5/8 3/4 7/8 1 1 1/4												
For a working life of 50 and	d 100 year	'S											
Steel failure													
Characteristic resistance		$N_{Rk,s,C1}$	[kN]				$A_s \cdot f_{uk}$						
Combined pullout and con-	crete con	e failure fo	or a worki	ing life c	of 50 yea	rs							
Characteristic 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: 24°	C / 40°C	$ au_{Rk,C1}$	$[N/mm^2]$	8,2	10,1	10,5	9,7	8,9	9,0	8,5			
Temperature range II: 43°	C / 55°C	$ au_{Rk,C1}$	$[N/mm^2]$	7,3	8,3	8,1	8,2	7,9	7,5	7,0			
Temperature range III: 55°0	C / 75°C	$ au_{Rk,C1}$	$[N/mm^2]$	3,2	3,2	3,3	2,9	3,0	3,0	2,5			
Combined pullout and con-	crete con	e failure fo	or a worki	ing life c	f 100 ye	ars							
Characteristic resistance in c in hammer drilled holes and ha and diamond cored holes with	ammer drill	led holes w	ith Hilti ho			or TE-YI)						
Temperature range I: 24°	C / 40°C	$ au_{Rk,100,C1}$	$[N/mm^2]$	7,3	7,8	8,1	7,8	7,4	7,5	6,5			
Temperature range II: 43°	C / 55°C	$ au_{Rk,100,C1}$	$[N/mm^2]$	6,4	6,9	7,1	6,8	6,9	6,5	6,0			
Temperature range III: 55°0	C / 75°C	$ au_{Rk,100,C1}$		3,2	3,2	3,3	2,9	3,0	3,0	2,5			
Influence factors ψ on bon	d resistar	nce $ au_{Rk,C1}$:	and $ au_{Rk,10}$	0,C1									
Influence of concrete strengt	h				_	_							
Temperature range I to III:		ψ_c	[-]				1,0						

Injection system Hilti HIT-RE 500 V4

Performance

Essential characteristics under tension load for seismic performance category C1 in concrete

Table C25: Essential characteristics for internally threaded sleeve HIS-(R)N under tension load for seismic category C1 in concrete

HIS-(R)N			M8	M10	M12	M16	M20
For a working life of 50 and 10	00 years						
Steel failure							
Characteristic resistance HIS-N	$N_{Rk,s,C1}$	[kN]	25	46	67	125	116
Characteristic resistance HIS-R	N $N_{Rk,s,C1}$	[kN]	26	41	59	110	166
Combined pullout and concre	te cone failure f	for a worki	ng life of 50) years			
Characteristic resistance in crac in hammer drilled holes and hammand diamond cored holes with rou	ner drilled holes v	vith Hilti hol			YD		
Temperature range I: 24°C /	40°C $\tau_{Rk,C1}$	[N/mm ²]	8,4	8,6	8,7	9,0	9,0
Temperature range II: 43°C /	55°C $\tau_{Rk,C1}$	[N/mm ²]	7,4	7,6	7,8	8,0	8,0
Temperature range III: 55°C /	75°C $\tau_{Rk,C1}$	[N/mm ²]	2,8	3,3	3,4	3,5	3,5
Combined pullout and concre	te cone failure f	for a worki	ng life of 10	00 years			
Characteristic resistance in crac in hammer drilled holes and hamr and diamond cored holes with rou	ner drilled holes v	vith Hilti hol			YD		
Temperature range I: 24°C /	40°C $\tau_{Rk,100,C}$	₁ [N/mm²]	6,5	6,7	6,8	7,0	7,0
Temperature range II: 43°C /	55°C τ _{Rk,100,C}	₁ [N/mm²]	5,6	6,2	6,3	6,5	6,5
Temperature range III: 55°C /		₁ [N/mm²]	2,8	2,9	2,9	3,0	3,0
Influence factors ψ on bond r			0,C1				
Influence of concrete strength							
Temperature range I to III:	ψ_c	[-]			1,0		

Performance

Essential characteristics under tension load for seismic performance category C1 in concrete

Table C26: Essential characteristics for threaded rod under tension load for seismic category C1 in concrete

HIS-(R)N, size		[in.]	3/8	1/2	5/8	3/4
For a working life of 50 and 100 year	ars					
Steel failure						
Characteristic resistance HIS-N Screw acc. to SAE J429 Grade 5 or ASTM A325 (1/2 in. to 3/4 in.)	$N_{Rk,s,C1}$	[kN]	41	76	121	130
Characteristic resistance HIS-N Screw acc. to ASTM A193 Grade B7	$N_{Rk,s,C1}$	[kN]	43	77	128	130
Characteristic resistance HIS-RN Screw acc. to ASTM A193 Grade B8I (AISI 316)	M $N_{Rk,s,C1}$	[kN]	38	110	182	185
Characteristic resistance HIS-RN Screw acc. to ASTM A193 Grade B8' (AISI 321)	T $N_{Rk,s,C1}$	[kN]	43	110	182	185
Combined pullout and concrete co	ne failure f	or a working	g life of 50 ye	ears		
Characteristic resistance in cracked of in hammer drilled holes and hammer drand diamond cored holes with rougher	rilled holes w	vith Hilti hollo		CD or TE-YD		
Temperature range I: 24°C / 40°C	$ au_{Rk,C1}$	[N/mm ²]	8,6	8,7	9,0	9,0
Temperature range II: 43°C / 55°C	$ au_{Rk,C1}$	[N/mm ²]	7,6	7,8	8,0	8,0
Temperature range III: 55°C / 75°C	$ au_{Rk,C1}$	[N/mm ²]	2,9	2,9	3,0	3,0
Combined pullout and concrete co	ne failure f	or a working	g life of 100 y	/ears		
01 1 11 1 1 1 1		0/25				
Characteristic resistance in cracked on hammer drilled holes and hammer drand diamond cored holes with rougher				CD or TE-YD		
in hammer drilled holes and hammer dr	ning with Hilt			CD or TE-YD	7,0	7,0
in hammer drilled holes and hammer dr and diamond cored holes with rougher	ning with Hilt $ au_{Rk,100,C1}$	i Roughening	tool TE-YRT		7,0 6,5	7,0 6,5
in hammer drilled holes and hammer dr and diamond cored holes with rougher Temperature range I: 24°C / 40°C	ning with Hilt $ au_{Rk,100,C1}$ $ au_{Rk,100,C1}$	i Roughening [N/mm²]	6,7	6,8	-	· · · · · · · · · · · · · · · · · · ·
in hammer drilled holes and hammer drand diamond cored holes with rougher Temperature range I: 24°C / 40°C Temperature range II: 43°C / 55°C	ning with Hilt $ au_{Rk,100,C1}$ $ au_{Rk,100,C1}$ $ au_{Rk,100,C1}$	i Roughening [N/mm²] [N/mm²] [N/mm²]	6,7 6,2 2,9	6,8 6,3	6,5	6,5
in hammer drilled holes and hammer drand diamond cored holes with rougher Temperature range I: 24°C / 40°C Temperature range II: 43°C / 55°C Temperature range III: 55°C / 75°C	ning with Hilt $ au_{Rk,100,C1}$ $ au_{Rk,100,C1}$ $ au_{Rk,100,C1}$	i Roughening [N/mm²] [N/mm²] [N/mm²]	6,7 6,2 2,9	6,8 6,3	6,5	6,5

Performance

Essential characteristics under tension load for seismic performance category C1 in concrete

Table C27: Essential characteristics for Hilti Tension anchor HZA / HZA-R under tension load for seismic category C1 in concrete

HZA / HZA-R			M12	M16	M20	M24	M27
Rebar diameter	φ	[mm]	12	16	20	25	28
For a working life of 50 and 100	years						
Steel failure							
Characteristic resistance HZA	$N_{Rk,s,C1}$	[kN]	46	86	135	194	253
Characteristic resistance HZA-R	$N_{Rk,s,C1}$	[kN]	62	111	173	248	1)
Combined pullout and concrete	cone failure	for a worki	ng life of 50) years			
Characteristic resistance in cracked in hammer drilled holes and hammer and diamond cored holes with rough	drilled holes	with Hilti hol			YD		
Temperature range I: 24°C / 40°	$^{\circ}$ C $ au_{Rk,C1}$	[N/mm ²]	11,0	11,4	11,6	10,9	11,0
Temperature range II: 43°C / 55	$^{\circ}$ C $ au_{Rk,C1}$	[N/mm ²]	9,2	9,5	9,7	9,4	9,5
Temperature range III: 55°C / 75	$^{\circ}$ C $ au_{Rk,C1}$	[N/mm ²]	3,7	3,8	3,4	3,5	3,5
Combined pullout and concrete	cone failure	for a worki	ng life of 10	00 years			
Characteristic resistance in cracker in hammer drilled holes and hammer and diamond cored holes with rough	drilled holes	with Hilti hol			YD		
Temperature range I: 24°C / 40°	$^{\circ}$ C $ au_{Rk,100,0}$	1 [N/mm²]	9,2	9,0	9,2	8,9	9,0
Temperature range II: 43°C / 55	$^{\circ}$ C $\tau_{Rk,100,0}$	1 [N/mm²]	8,3	8,1	8,2	7,9	8,0
Temperature range III: 55°C / 75	$^{\circ}$ C $\tau_{Rk,100,0}$	1 [N/mm²]	3,7	3,8	3,4	3,5	3,5
Influence factors ψ on bond resi	stance $ au_{Rk,C}$	and $ au_{Rk,100}$	0,C1				
Influence of concrete strength							
Temperature range I to III:	ψ_c	[-]			1,0		

No performance assessed.

Performance

Essential characteristics under tension load for seismic performance category C1 in concrete

Table C28: Essential characteristics for reinforcing bars (rebars) under tension load for seismic category C1 in concrete

Reinforcing bar (rebar)				φ10	φ12	φ14	φ16	φ18	φ20	φ24	φ25	φ28	φ30	φ32
For a working life of 50 a	ınd 100 year	s												
Steel failure														
Characteristic resistance		$N_{Rk,s,C1}$	[kN]					A_{\cdot}	$s \cdot f_{uk}$	1)				
Characteristic resistance F B500B acc. to DIN 488 2)	Rebar	$N_{Rk,s,C1}$	[kN]	43	62	85	111	140	173	249	270	339	389	442
Combined pullout and concrete cone failure for a working life of 50 years														
Characteristic resistance in cracked concrete C20/25 n 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: 2	4°C / 40°C	$ au_{Rk,C1}$	[N/mm ²]	9,1	11,0	11,0	11,4	11,5	11,6	10,8	10,9	11,0	11,0	11,0
Temperature range II: 4	3°C / 55°C	$ au_{Rk,C1}$	[N/mm ²]	7,7	9,2	9,2	9,5	9,6	9,7	9,3	9,4	9,5	9,5	9,0
Temperature range III: 5	5°C / 75°C	$ au_{Rk,C1}$	[N/mm ²]	3,6	3,7	3,7	3,8	3,8	3,4	3,4	3,5	3,5	3,5	3,5
Combined pullout and co	oncrete con	e failure fo	or a work	ing li	e of 1	100 ye	ears							
Characteristic resistance in hammer drilled holes and and diamond cored holes w	hammer drill	ed holes w	ith Hilti ho			_	D or T	E-YD						
Temperature range I: 2	4°C / 40°C	$ au_{Rk,100,C1}$	[N/mm ²]	8,2	9,2	9,2	9,0	9,1	9,2	8,8	8,9	9,0	9,0	9,0
Temperature range II: 4	3°C / 55°C	$ au_{Rk,100,C1}$	[N/mm²]	7,3	8,3	8,3	8,1	8,2	8,2	7,8	7,9	8,0	8,0	8,0
Temperature range III: 5	5°C / 75°C	$ au_{Rk,100,C1}$	[N/mm²]	3,6	3,7	3,7	3,8	3,8	3,4	3,4	3,5	3,5	3,5	3,5
Influence factors ψ on be	ond resistar	ce $ au_{Rk,C1}$ a	and $ au_{Rk,10}$	00, <i>C</i> 1										
Influence of concrete stren			•											
Temperature range I to III:		ψ_c	[-]						1,0					

Injection system Hilti HIT-RE 500 V4

Performance

Essential characteristics under tension load for seismic performance category C1 in concrete

 f_{uk} according to rebar specification. Values need to be calculated acc. EAD 330499-02, Eq. 2.1, if rebars do not fulfil the requirements acc. DIN 488.

Table C29: Essential characteristics for metric threaded rod according Annex A under shear load for seismic category C1 in concrete

Threaded rod, HAS-U, HIT-V, AM		M8	M10	M12	M16	M20	M24	M27	M30	
For a working life of 50 and 100 years										
Annular gap factor without Hilti Filling Set	α_{gap}	[-]				0	,5			
Annular gap factor with Hilti Filling Set	α_{gap}	[-]			1	,0			1)
Steel failure without lever arm										
Characteristic resistance HAS 5.8, HAS-U-5.8, HIT-V-5.8	$V_{Rk,s,C1}$	[kN]	$0.6 \cdot A_s \cdot f_{uk}$							
Characteristic resistance HAS 8.8, HAS-U-8.8., HIT-V-8.8, AM8.8	$V_{Rk,s,C1}$	[kN]	N] $0.5 \cdot A_s \cdot f_{uk}$							
Characteristic resistance Commercial standard threaded rod	$V_{Rk,s,C1}$	[kN]				0,35 ·	$A_s \cdot f_{uk}$			

¹⁾ No performance assessed.

Table C30: Essential characteristics for fractional threaded rod according Annex A under shear load for seismic category C1 in concrete

Threaded rod, HAS, HIT-V, size	readed rod, HAS, HIT-V, size [in					3/4	7/8	1	1 1/4
For a working life of 50 and 100 years									
Annular gap factor without Hilti Filling Se	t α_{gap}	[-]				0,5			
Steel failure without lever arm									
Characteristic resistance HAS, HIT-V	$V_{Rk,s,C1}$	[kN]			0	$, 5 \cdot A_s \cdot f_i$	ık		
Characteristic resistance Commercial standard threaded rod	$V_{Rk,s,C1}$	[kN]			0,	$35 \cdot A_s \cdot f$	uk		

Table C31: Essential characteristics for internally threaded sleeve HIS-(R)N under shear load for seismic category C1 in concrete

HIS-(R)N		M8	M10	M12	M16	M20	
For a working life of 50 and 100 years							
Annular gap factor without Hilti Filling Se	t α_{gap}	[-]			0,5		
Annular gap factor with Hilti Filling Set	α_{gap}	[-]			1,0		
Steel failure without lever arm							
Characteristic resistance HIS-N with screw 8.8	$V_{Rk,s,C1}$	[kN]	9,0	16	27	41	39
Characteristic resistance HIS-RN with screw grade 70	$V_{Rk,s,C1}$	[kN]	9,0	14	21	39	58

Performance

Essential characteristics under shear load for seismic performance category C1 in concrete

Table C32: Essential characteristics for internally threaded sleeve HIS-(R)N under shear load for seismic category C1 in concrete

HIS-(R)N, size		[in.]	3/8	1/2	5/8	3/4
For a working life of 50 and 100 years						
Annular gap factor without Hilti Filling Set	α_{gap}	[-]		0	,5	
Steel failure without lever arm						
Characteristic resistance HIS-N Screw acc. to SAE J429 Grade 5 or ASTM A325 (1/2 in. to 3/4 in.)	$V_{Rk,s,C1}$	[kN]	14	27	42	45
Characteristic resistance HIS-N Screw acc. to ASTM A193 Grade B7	$V_{Rk,s,C1}$	[kN]	15	28	44	45
Characteristic resistance HIS-RN Screw acc. to ASTM A193 Grade B8M (AISI 316)	$V_{Rk,s,C1}$	[kN]	13	24	39	65
Characteristic resistance HIS-RN Screw acc. to ASTM A193 Grade B8T (AISI 321)	$V_{Rk,s,C1}$	[kN]	15	28	44	65

Table C33: Essential characteristics for Hilti Tension anchor HZA / HZA-R under shear load for seismic category C1 in concrete

HZA / HZA-R		M12	M16	M20	M24	M27	
For a working life of 50 and 100 years	3						
Annular gap factor without Hilti Filling Se	et α_{gap}	[-]			0,5		
Steel failure without lever arm							
Characteristic resistance HZA	$V_{Rk,s,C1}$	[kN]	23	43	67	97	126
Characteristic resistance HZA-R	$V_{Rk,s,C1}$	[kN]	31	55	86	124	1)

¹⁾ No performance assessed.

Table C34: Essential characteristics for reinforcing bars (rebars) under shear load for seismic category C1 in concrete

Reinforcing bar (rebar)		φ10	φ12	φ14	φ16	φ18	φ20	φ24	φ25	φ28	φ30	φ32	
For a working life of 50 and 100 years													
Steel failure without lever arm													
Characteristic resistance	$V_{Rk,s,C1}$	[kN]					0,35	$\cdot A_s \cdot$	$f_{uk}^{-1)}$				
Characteristic resistance Rebar B500B acc. to DIN 488 ²⁾	$V_{Rk,s,C1}$	[kN]	15	22	30	39	49	60	87	95	118	136	155

 f_{uk} according to rebar specification.

Injection system Hilti HIT-RE 500 V4

Performance

Essential characteristics under shear load for seismic performance category C1 in concrete

Values need to be calculated acc. EAD 330499-02, Eq. 2.1, if rebars do not fulfil the requirements acc. DIN 488.

Table C35: Essential characteristics for metric threaded rod according Annex A under tension load for seismic category C2 in concrete

Metric threaded rod according A		M12	M16	M20	M24	M27	M30		
For a working life of 50 and 100	years							•	
Steel failure									
Characteristic resistance HAS (8.8, 8.8 HDG, A4), HAS-U (8.8, 8.8 HDG, A4, HCR), HIT-V (-8.8, -8.8F, -R, -HCR), AM (8.8, 8.8 HDG), Threaded rod (electroplated zinc coated 8.8, CRC II, CRC III and CRC V, see Table A1)	$N_{Rk,s,C2}$	[kN]	$] \qquad \qquad A_S \cdot f_{uk}$						
Combined pullout and concrete cone failure for a working life of 50 years									
Characteristic resistance in cracker in hammer drilled holes and hammer			llow drill b	it TE-CD o	r TE-YD				
Temperature range I: 24°C / 40°	$^{\circ}$ C $ au_{Rk,C2}$	[N/mm ²]	3,7	6,5	5,8	6,0	5,0	5,2	
Temperature range II: 43°C / 55	$^{\circ}$ C $ au_{Rk,C2}$	[N/mm ²]	3,1	5,3	4,8	5,0	4,2	4,3	
Temperature range III: 55°C / 75	$^{\circ}$ C $ au_{Rk,C2}$	[N/mm ²]	1,2	2,1	1,9	1,9	1,6	1,7	
Combined pullout and concrete	cone failure	for a worki	ng life of	100 years	5			•	
Characteristic resistance in cracker in hammer drilled holes and hammer			llow drill b	oit TE-CD o	r TE-YD				
Temperature range I: 24°C / 40	$^{\circ}$ C $ au_{Rk,100,C}$	₂ [N/mm ²]	3,7	6,5	5,8	6,0	5,0	5,2	
Temperature range II: 43°C / 55		₂ [N/mm ²]	3,0	5,3	4,8	4,9	4,1	4,3	
Temperature range III: 55°C / 75		₂ [N/mm ²]	1,2	2,1	1,9	1,9	1,6	1,7	
Influence factor ψ on bond resis			C2						
Influence of concrete strength									
Temperature range I to III:	ψ_c	[-]			1	,0			

Performance

Essential characteristics under tension load for seismic performance category C2 in concrete

Table C36: Essential characteristics for metric threaded rod according Annex A under shear load for seismic category C2 in concrete

Metric threaded rod according Annex	A		M12	M16	M20	M24	M27	M30
For a working life of 50 and 100 years								
Annular gap factor without Hilti Filling Set	α_{gap}	[-]			0	,5		
Annular gap factor with Hilti Filling Set	gap factor with Hilti Filling Set $lpha_{gap}$ [1	,0		1	1)
Steel failure without lever arm with Hil-	Steel failure without lever arm with Hilti Filling Set							
Characteristic resistance HAS 8.8, HAS-U 8.8, HIT-V-8.8, AM 8.8	$V_{Rk,s,C2}$	[kN]	28	46	77	103	1	1)
Steel failure without lever arm without	Hilti Filli	ng Set						
Characteristic resistance HAS 8.8, HAS-U 8.8, HIT-V-8.8, AM 8.8	$V_{Rk,s,C2}$	[kN]	24	40	71	90	121	135
Characteristic resistance HAS 8.8, HAS-U 8.8 HDG, HIT-V-8.8F, AM HDG 8.8	$V_{Rk,s,C2}$	[kN]	18	30	46	66	1	1)
Characteristic resistance HAS A4, HAS-U A4, HIT-V-R	$V_{Rk,s,C2}$	[kN]	21	35	62	79	76	84
Characteristic resistance HAS-U HCR, HIT-V-HCR	$V_{Rk,s,C2}$	[kN]	24	40	71	79	106	118
Characteristic resistance Commercial standard threaded rod 8.8	$V_{Rk,s,C2}$	[kN]	17	28	50	63	85	95
Characteristic resistance Commercial standard threaded rod A4	$V_{Rk,s,C2}$	[kN]	15	25	43	55	53	59
Characteristic resistance Commercial standard threaded rod HCR	$V_{Rk,s,C2}$	[kN]	17	28	50	55	74	83

No performance assessed.

Performance

Essential characteristics under shear load for seismic performance category C2 in concrete

Table C37: Displacements for metric threaded rod according Annex A under tension load for seismic category C2 in concrete

Metric threaded rod according Annex A			M12	M16	M20	M24	M27	M30
Threaded rod, HAS 8.8, HAS-U-	$\delta_{N,C2(DLS)}$	[mm]	0,2	0,5	0,5	0,4	0,4	0,5
, HIT-V, AM8.8	$\delta_{N,C2(ULS)}$	[mm]	0,6	1,2	0,9	0,8	1,0	0,9

Table C38: Displacements for metric threaded rod according Annex A under shear load for seismic category C2 in concrete

Metric threaded rod according A	nnex A		M12	M16	M20	M24	M27	M30
Installation with Hilti Filling Set								
HAS 8.8, HAS-U 8.8, HIT-V 8.8,	$\delta_{V,C2(DLS)}$	[mm]	0,6	1,2	1,4	1,1	1)
AM 8.8	$\delta_{V,C2(ULS)}$	[mm]	3,1	3,2	3,7	2,6	1)
Installation without Hilti Filling S	Set							
Threaded rod, HAS, HAS-U,	$\delta_{V,C2(DLS)}$	[mm]	1,9	3,2	2,5	3,5	3,0	1,9
HIT-V, AM 8.8	$\delta_{V,C2(ULS)}$	[mm]	4,4	9,2	7,1	10,2	7,2	6,3
HAS 8.8 HDG, HAS-U 8.8 HDG,	$\delta_{V,C2(DLS)}$	[mm]	2,2	2,3	3,8	3,4	1)
HIT-V-F 8.8, AM HDG 8.8	$\delta_{V,C2(ULS)}$	[mm]	4,1	4,3	9,1	8,4	1)

¹⁾ No performance assessed.

Injection system Hilti HIT-RE 500 V4

Performance

Displacements for seismic performance category C2 in concrete

Characteristic bond resistance of a single bonded fastener $\tau_{Rk,fi,p}(\theta)$ for concrete strength classes C20/25 to C50/60 with all drilling methods under fire conditions²

The characteristic bond resistance of a single bonded fastener under fire conditions $\tau_{Rk,fi,p}$ for a given temperature (θ) shall be calculated using the following equations:

$$\tau_{Rk,fi,p}(\theta) = k_{fi,p}(\theta) \cdot \tau_{Rk,cr,C20/25}$$

where: $\theta \le \theta_{max}$: $k_{fi,p}(\theta) = k_{fi,p,100y}(\theta) = 39.83 \cdot \theta^{-1.266} \le 1.0$

and $\theta < \theta_{max}$: $k_{fi,p}(\theta) = k_{fi,p,100y}(\theta) = 0.0$

 $\theta_{max} = 305^{\circ}C$

 $\tau_{Rk,fi,p}$ = characteristic bond resistance for cracked concrete under fire exposure for a

given temperature (θ)

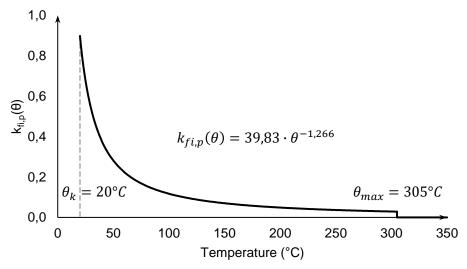
 $k_{fi,p}(\theta)$ = reduction factor for bond resistance under fire exposure

 $\tau_{Rk,cr,C20/25}$ = characteristic bond resistance for cracked concrete for concrete strength class

C20/25 for the relevant temperature range

Figure C5: Reduction factor $k_{fi.p}(\theta)$

Temperature reduction factor



Injection system Hilti HIT-RE 500 V4

Performance

Reduction factor for pull-out failure of single fasteners under fire conditions

² Refer to Annex B1 for the characteristic resistance of a fastener, a group of fasteners and the tensioned fasteners of a group of fasteners in case of combined pull-out and concrete failure under fire conditions $N_{Rk,n,fi}$

Table C39: Characteristic resistance under tension load in case of steel failure under fire conditions

Fastener size			М8	M10	M12	M16	M20	M24	M27	M30
HAS 5.8, 5.8 HDG	$N_{Rk,s,fi(30)}$	[kN]	1,04	1,77	2,76	5,15	8,04	11,58	15,05	18,40
	$N_{Rk,s,fi(60)}$	[kN]	0,81	1,34	2,03	3,79	5,91	8,51	11,07	13,53
HAS-U 8.8, 8.8 HDG	$N_{Rk,s,fi(90)}$	[kN]	0,59	0,91	1,30	2,42	3,78	5,45	7,09	8,66
HIT-V 5.8, 5.8F HIT-V 8.8, 8.8F	$N_{Rk,S,fi(120)}$	[kN]	0,47	0,70	0,94	1,74	2,72	3,92	5,09	6,22
	$N_{Rk,s,fi(30)}$	[kN]	2,67	4,85	7,94	14,78	23,06	33,23	43,21	52,81
HAS A4 HAS-U A4-70	$N_{Rk,s,fi(60)}$	[kN]	1,93	3,44	5,57	10,37	16,18	23,32	30,32	37,06
HAS-U HCR	$N_{Rk,s,fi(90)}$	[kN]	1,18	2,03	3,20	5,96	9,30	13,40	17,43	21,30
	$N_{Rk,s,fi(120)}$	[kN]	0,80	1,33	2,02	3,76	5,86	8,44	10,98	13,42

Table C40: Characteristic resistance under tension load in case of steel failure under fire conditions

Fastener size		[in.]	3/8	1/2	5/8	3/4	7/8	1	1 1/4
	$N_{Rk,s,fi(30)}$	[kN]	1,50	3,00	4,78	7,08	9,77	12,82	20,50
HAS-E-55	$N_{Rk,s,fi(60)}$	[kN]	1,15	2,21	3,52	5,20	7,18	9,42	15,08
HAS-B-105 (HDG)	$N_{Rk,s,fi(90)}$	[kN]	0,79	1,41	2,25	3,33	4,60	6,03	9,65
	$N_{Rk,s,fi(120)}$	[kN]	0,61	1,02	1,62	2,39	3,31	4,34	6,94

Table C41: Characteristic resistance under tension load in case of concrete cone and splitting failure under fire conditions

Fastener size			M8, M10, M12, M16, M20, M24, M27, M30 [in.] 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/4
HAS 5.8, 5.8 HDG HAS 8.8, 8.8 HDG	$N_{Rk,c,fi(30)}^0$	[kN]	
HAS-U 5.8, 5.8 HDG HAS-U 8.8, 8.8 HDG HIT-V 5.8, 5.8F HIT-V 8.8, 8.8F	$N_{Rk,c,fi(60)}^0$	[kN]	$\frac{h_{ef}}{200} \cdot N_{Rk,c}^0 \le N_{Rk,c}^0$
HAS-E-55 HAS-B-105 (HDG) HAS A4	$N_{Rk,c,fi(90)}^0$	[kN]	
HAS-U A4-70 HAS-U HCR	$N_{Rk,c,fi(120)}^0$	[kN]	$0.8 \cdot \frac{h_{ef}}{200} \cdot N_{Rk,c}^0 \le N_{Rk,c}^0$
Characteristic spacing	$S_{cr,N,fi}$	[mm]	$4h_{ef}$
Characteristic edge distance	$C_{cr,N,fi}$	[mm]	$2h_{ef}$

Injection system Hilti HIT-RE 500 V4

Performance

Characteristic resistance under tension load in case of steel and concrete cone failure under fire conditions

Table C42: Characteristic resistance under shear load in case of steel failure under fire conditions

Fastener size			M8	M10	M12	M16	M20	M24	M27	M30
HAS 5.8, 5.8 HDG HAS 8.8, 8.8 HDG HAS-U 5.8, 5.8 HDG HAS-U 8.8, 8.8 HDG HIT-V 5.8, 5.8F HIT-V 8.8, 8.8F	$V_{Rk,s,fi(30)}$	[kN]	1,04	1,77	2,76	5,15	8,04	11,58	15,05	18,40
	$V_{Rk,s,fi(60)}$	[kN]	0,81	1,34	2,03	3,79	5,91	8,51	11,07	13,53
	$V_{Rk,s,fi(90)}$	[kN]	0,59	0,91	1,30	2,42	3,78	5,45	7,09	8,66
	$V_{Rk,s,fi(120)}$	[kN]	0,47	0,70	0,94	1,74	2,72	3,92	5,09	6,22
	$M_{Rk,s,fi(30)}^0$	[Nm]	1,06	2,28	4,29	10,92	21,28	36,81	54,58	73,76
	$M_{Rk,s,fi(60)}^{o}$	[Nm]	0,83	1,73	3,15	8,02	15,65	27,07	40,14	54,23
	$M_{Rk,s,fi(90)}^0$	[Nm]	0,60	1,17	2,02	5,13	10,01	17,32	25,69	34,71
	$M_{Rk,s,fi(120)}^0$	[Nm]	0,48	0,89	1,45	3,69	7,20	12,45	18,46	24,95
HAS A4 HAS-U A4-70 HAS-U HCR	$V_{Rk,s,fi(30)}$	[kN]	2,67	4,85	7,94	14,78	23,06	33,23	43,21	52,81
	$V_{Rk,s,fi(60)}$	[kN]	1,93	3,44	5,57	10,37	16,18	23,32	30,32	37,06
	$V_{Rk,s,fi(90)}$	[kN]	1,18	2,03	3,20	5,96	9,30	13,40	17,43	21,30
	$V_{Rk,s,fi(120)}$	[kN]	0,80	1,33	2,02	3,76	5,86	8,44	10,98	13,42
	$M_{Rk,s,fi(30)}^0$	[Nm]	2,73	6,25	12,33	31,34	61,10	105,67	156,68	211,71
	$M_{Rk,s,fi(60)}^0$	[Nm]	1,97	4,43	8,65	21,99	42,87	74,14	109,93	148,55
	$M_{Rk,s,fi(90)}^{0}$	[Nm]	1,20	2,62	4,97	12,64	24,64	42,61	63,19	85,38
	$M_{Rk,s,fi(120)}^0$	[Nm]	0,82	1,71	3,13	7,96	15,52	26,85	39,81	53,80

Table C43: Characteristic resistance under shear load in case of steel failure under fire conditions

Fastener size		[in.]	3/8	1/2	5/8	3/4	7/8	1	1 1/4
HAS-E-55 HAS-B-105 (HDG)	$V_{Rk,s,fi(30)}$	[kN]	1,50	3,00	4,78	7,08	9,77	12,82	20,50
	$V_{Rk,s,fi(60)}$	[kN]	1,15	2,21	3,52	5,20	7,18	9,42	15,08
	$V_{Rk,s,fi(90)}$	[kN]	0,79	1,41	2,25	3,33	4,60	6,03	9,65
	$V_{Rk,s,fi(120)}$	[kN]	0,61	1,02	1,62	2,39	3,31	4,34	6,94
	$M_{Rk,s,fi(30)}^0$	[Nm]	1,96	4,45	9,77	17,59	28,54	42,88	86,77
	$M_{Rk,s,fi(60)}^0$	[Nm]	1,44	3,39	7,18	12,94	20,98	31,53	63,81
	$M_{Rk,s,fi(90)}^0$	[Nm]	0,92	2,34	4,59	8,28	13,43	20,18	40,84
	$M_{Rk,s,fi(120)}^0$	[Nm]	0,66	1,81	3,30	5,95	9,65	14,50	29,35

Performance

Characteristic resistance under shear load in case of steel failure under fire conditions

Table C44: Characteristic resistance under shear load in case of pryout failure under fire conditions

Fastener size			M8, M10, M12, M16, M20, M24, M27, M30 [in.] 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/4
HAS 5.8, 5.8 HDG HAS 8.8, 8.8 HDG HAS-U 5.8, 5.8 HDG	$V_{Rk,cp,fi(30)}$	[kN]	
HAS-U 8.8, 8.8 HDG HIT-V 5.8, 5.8F HIT-V 8.8, 8.8F HAS-E-55 HAS-B-105 (HDG) HAS A4 HAS-U A4-70 HAS-U HCR	$V_{Rk,cp,fi(60)}$	[kN]	$k_8 \cdot N_{Rk,c,fi(90)}$
	$V_{Rk,cp,fi(90)}$	[kN]	
	$V_{Rk,cp,fi(120)}$	[kN]	$k_8 \cdot N_{Rk,c,fi(120)}$

Table C45: Characteristic resistance under shear load in case of concrete edge failure under fire conditions

Fastener size			M8, M10, M12, M16, M20, M24, M27, M30 [in.] 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/4
HAS 5.8, 5.8 HDG HAS 8.8, 8.8 HDG HAS-U 5.8, 5.8 HDG	$V_{Rk,c,fi(30)}$	[kN]	
HAS-U 5.0, 5.8 HDG HAS-U 8.8, 8.8 HDG HIT-V 5.8, 5.8F HIT-V 8.8, 8.8F HAS-E-55 HAS-B-105 (HDG) HAS A4 HAS-U A4-70 HAS-U HCR	$V_{Rk,c,fi(60)}$	[kN]	$0,25\cdot V^0_{Rk,c}$
	$V_{Rk,c,fi(90)}$	[kN]	
	$V_{Rk,c,fi(120)}$	[kN]	$0.20 \cdot V_{Rk,c}^0$

Injection system Hilti HIT-RE 500 V4

Performance

Characteristic resistance under shear load in case of concrete pryout and concrete edge failure under fire conditions