



## Designated according to The Construction Products (Amendment etc.) (EU Exit) Regulations 2020

<b>UK Technical Assessment</b>	<b>UKTA-0836-22/6577 of 28/03/2023</b>
Technical Assessment Body issuing the UK Technical Assessment:	British Board of Agrément
Trade name of the construction product:	Injection system Hilti HIT-RE 500 V4 for rebar connection
Product family to which the construction product belongs:	Post installed rebar connections diameter 8 to 40 mm made with Hilti HIT-RE 500 V4 injection mortar for a working life of 100 years
Manufacturer:	Hilti Corporation Feldkircherstrasse 100 FL-9494 Schaan Principality of Liechtenstein
Manufacturing plant(s):	Hilti plants
This UK Technical Assessment contains:	33 pages including 3 Annexes which form an integral part of this assessment
This UK Technical Assessment is issued in accordance with The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 on the basis of:	UKAD 330087-00-0601 Systems for post-installed rebar connections with mortar

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### 1. Technical description of the product

The Hilti HIT-RE 500 V4 is used for the connection, by anchoring or overlap joint, of reinforcing bars (rebars) in existing structures made of ordinary non-carbonated concrete C12/15 to C50/60. The design of the post-installed rebar connections is done in accordance with EN 1992-1-1: 2004 + A1: 2014 and EN 1992-1-2: 2004 + A1: 2019 under static loading. Covered are rebar anchoring systems consisting of Hilti HIT-RE 500 V4 bonding material and the Hilti tension anchor HZA sizes M12 to M27 or HZA-R sizes M12 to M24 or an embedded straight deformed reinforcing bar diameter, d, from 8 to 40 mm with properties according to Annex C of EN 1992-1-1: 2004 + A1: 2014 and EN 10080:2005. Classes B and C of the rebar are recommended. The illustration and the description of the product are given in Annex A.

### 2. Specification of the intended use(s) in accordance with the applicable UK Assessment Document (hereinafter UKAD)

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

The provisions made in this UK Technical Assessment are based on an assumed working life of the anchor of 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 and references to the methods used for its assessment

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

Essential characteristic	Performance
Characteristic resistance under static and quasi-static loading	See Annex C1 to C3

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

Essential characteristic	Performance
Reaction to fire	Anchorage satisfy requirements for Class A1
Resistance to fire	See Annexes C6 and C7

#### 3.3. Health, hygiene, and the environment (BWR 3)

Regarding dangerous substances contained in this UK Technical Assessment, there may be requirements applicable to the products falling within its scope (e.g., UK legislation and laws, regulations, and administrative provisions).

#### 3.4. Safety and accessibility in use (BWR 4)

For Basic Works Requirement 4: Safety and accessibility in use, the same criteria are valid as those which are stated for Basic Works Requirement 1: 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)**

No performance assessed.

### **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 (hereinafter AVCP) system applied**

### **4.1. System of assessment and verification of constancy of performance**

According to UKAD No. 330087-00-0601 and Annex V of the Construction Products Regulation (Regulation (EU) 305/2011) as brought into UK law and amended, the system of assessment and verification of constancy of performance (AVCP) 1 applies.

## **5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable UKAD**

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the British Board of Agrément and made available to the UK Approved Bodies involved in the conformity attestation process.

### **5.1. UKCA marking for the product/ system must contain the following information:**

- Identification number of the Approved Body
- Name/address of the manufacturer of the product/ system
- Marking with intention of clarification of intended use
- Date of marking
- Number of Certificate of Constancy of Performance
- UKTA number.

On behalf of the British Board of Agrément



Date of Issue: 28 March 2023

**Hardy Giesler**  
Chief Executive Officer



**British Board of Agrément,**  
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## ANNEX A1

### Product description

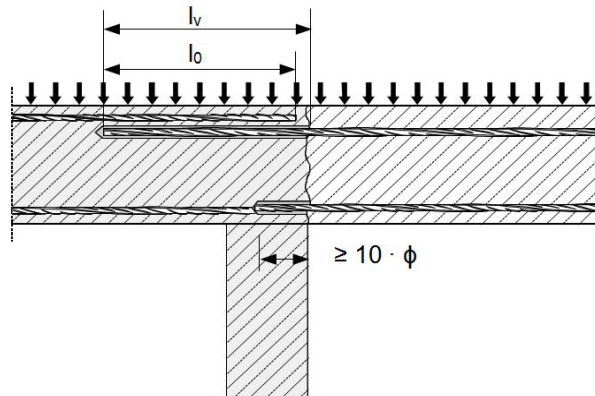
#### Installed condition: application examples of post-installed rebars

This annex applies to the product described in the main body of the UK Technical Assessment.

### Installed condition

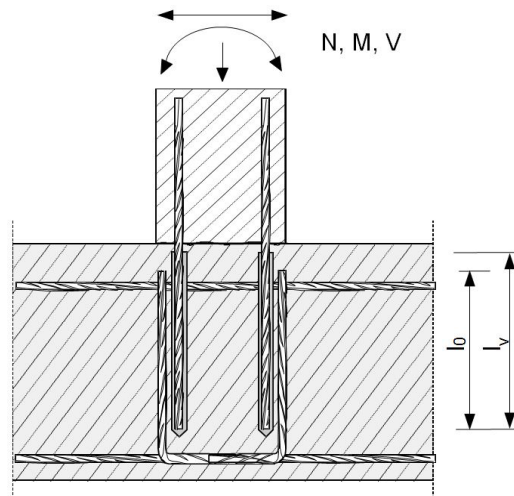
#### Figure A1:

Overlap joint with existing reinforcement for rebar connections of slabs and beams



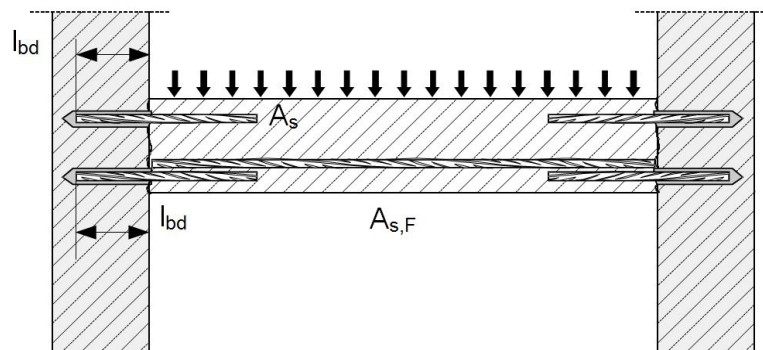
#### Figure A2:

Overlap joint with existing reinforcement at a foundation of a column or wall where the rebars are stressed in tension



#### Figure A3:

End anchoring of slabs or beams



## ANNEX A2

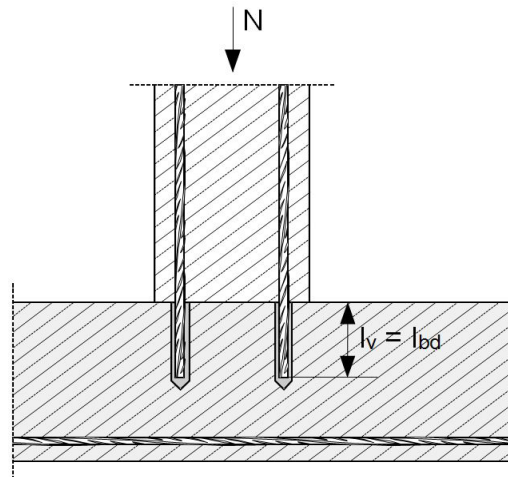
### Product description

#### Installed condition: application examples of post-installed rebars

This annex applies to the product described in the main body of the UK Technical Assessment.

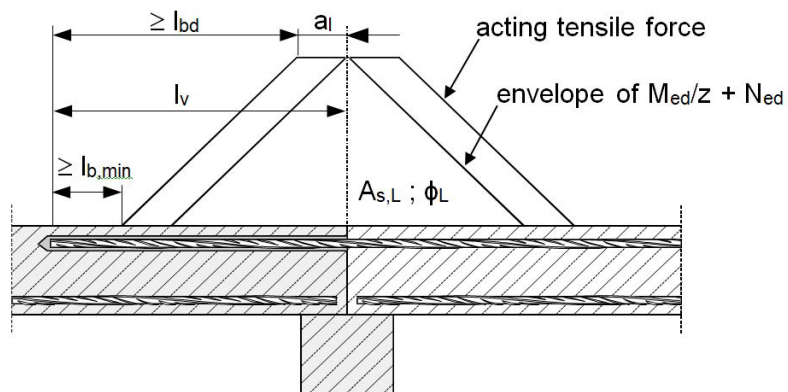
#### **Figure A4:**

#### **Rebar connection for components stressed primarily in compression**



#### **Figure A5:**

#### **Anchoring of reinforcement to cover the enveloped line of acting tensile force in the bending member**



#### **Note to Figure A1 to Figure A5:**

- In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by EN 1992-1-1: 2004 + A1: 2014 or EN 1998-1: 2004 + A1: 2013 shall be present.
- The shear transfer between existing and new concrete shall be designed according to EN 1992-1-1: 2004 + A1: 2014 or EN 1998-1: 2004 + A1: 2013.
- Preparing of joints according to Annex B2.

The reference to EN 1992-1-1: 2004 + A1: 2014 is cited in the following as EN 1992-1-1: 2004 + A1: 2014 only.

The reference to EN 1998-1: 2004 + A1: 2013 is cited in the following as EN 1998-1: 2004 + A1: 2013 only.

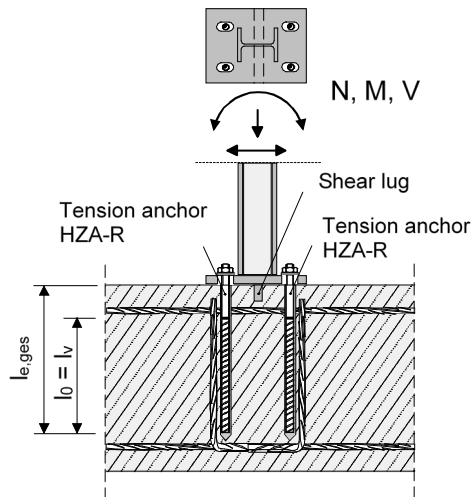
## ANNEX A3

### Product description

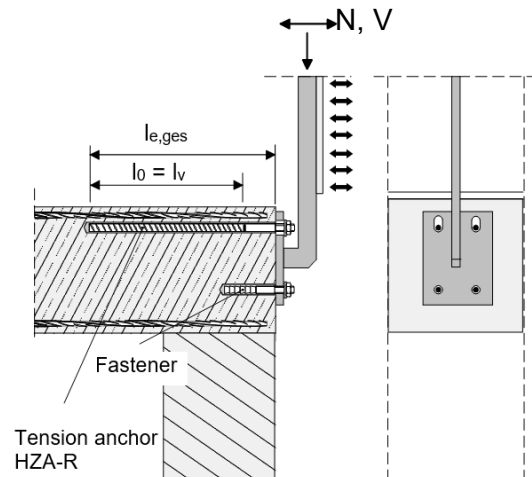
#### Installed condition: application examples of HZA and HZA-R

This annex applies to the product described in the main body of the UK Technical Assessment.

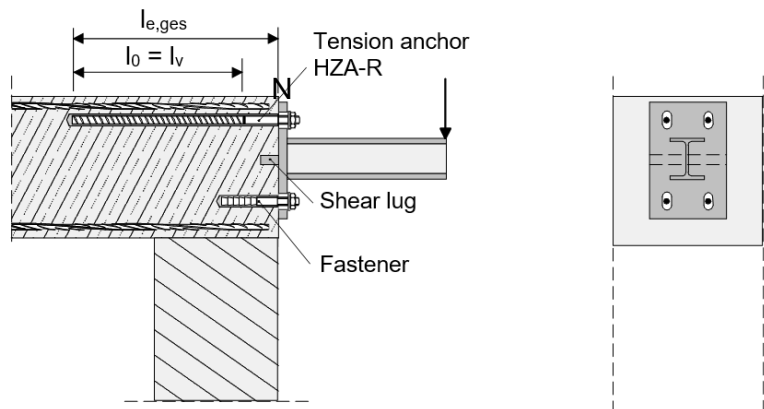
**Figure A6:**  
Overlap joint for the anchorage of a column stressed in bending to a foundation



**Figure A7:**  
Overlap joint for the anchorage of barrier posts



**Figure A8:**  
Overlap joint for the anchorage of cantilever members



#### Note to Figure A6 to Figure A8:

- In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by EN 1992-1-1: 2004 + A1: 2014 shall be present.

## ANNEX A4

### Product description

#### Injection mortar / Static mixer / Steel elements

This annex applies to the product described in the main body of the UK Technical Assessment.

#### Injection mortar Hilti HIT-RE 500 V4: epoxy system with aggregate

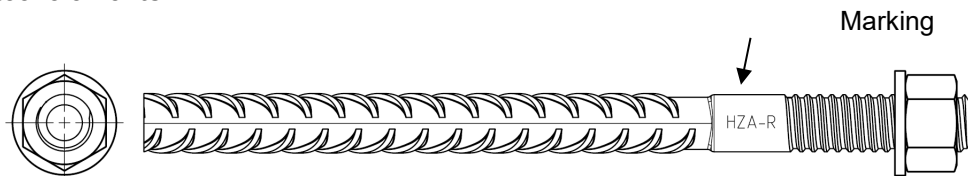
330 ml, 500 ml and 1400 ml



#### Static mixer Hilti HIT-RE-M



#### Steel elements

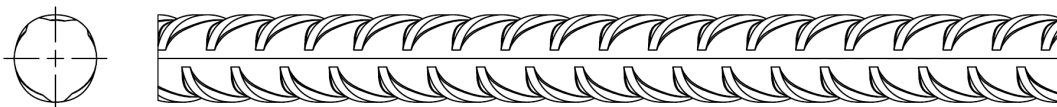


#### Hilti Tension Anchor HZA: M12 to M27

#### Hilti Tension Anchor HZA-R: M12 to M24

Marking:

embossing "HZA-R" M .. / tfix



#### Reinforcing bar (rebar): $\phi$ 8 to $\phi$ 40

- Materials and mechanical properties according to Table A1
- Minimum value of related rib area  $f_R$  according to EN 1992-1-1: 2004 + A1: 2014
- Rib height of the bar  $h_{rib}$  shall be in the range:

$$0,05 \cdot \phi \leq h_{rib} \leq 0,07 \cdot \phi$$

- The maximum outer rebar diameter over the ribs shall be:

$$\phi + 2 \cdot 0,07 \cdot \phi = 1,14 \cdot \phi$$

( $\phi$ : nominal diameter of the bar;  $h_{rib}$ : rib height of the bar)



## ANNEX A5

### Product description Materials

This annex applies to the product described in the main body of the UK Technical Assessment.

**Table A1: Materials**

Designation	Material
<b>Reinforcing bars (rebars)</b>	
Rebar EN 1992-1-1: 2004 + A1: 2014, 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: 2004 + A1: 2014 $f_{uk} = f_{tk} = k \cdot f_{yk}$
<b>Metal parts made of zinc coated steel</b>	
Hilti tension anchor HZA	Round steel with threaded part: electroplated zinc coated $\geq 5 \mu\text{m}$ Rebar: $f_{yk} = 500 \text{ N}\cdot\text{mm}^{-2}$ class B according to NDP or NCL of EN 1992-1-1: 2004 + A1: 2014
Washer	Electroplated zinc coated $\geq 5 \mu\text{m}$ , hot dip galvanized $\geq 50 \mu\text{m}$
Nut	Nominal strength class of nut equal or higher than nominal strength class of rod. Electroplated zinc coated $\geq 5 \mu\text{m}$ , hot dip galvanized $\geq 50 \mu\text{m}$
<b>Metal parts made of stainless steel</b>	
Corrosion class III according to EN 1993-1-4: 2006 + A2: 2020	
Hilti tension anchor HZA-R	Round steel with threaded part: Stainless steel according to EN 10088-1:2014 Rebar: $f_{yk} = 500 \text{ N}\cdot\text{mm}^{-2}$ class B according to NDP or NCL of EN 1992-1-1: 2004 + A1: 2014
Washer	Stainless steel according to EN 10088-1:2014
Nut	Nominal strength class of nut equal or higher than nominal strength class of rod. Stainless steel according to EN 10088-1:2014

## ANNEX B1

### Intended use, Specifications

This annex applies to the product described in the main body of the UK Technical Assessment.

### Specifications of intended use

#### Anchorage subject to:

- Static and quasi static loading: rebar  $\phi$  8 to  $\phi$  40, HZA M12 to M27 and HZA-R M12 to M24.
- Fire exposure: rebar  $\phi$  8 to  $\phi$  40, HZA M12 to M27 and HZA-R M12 to M24.

#### Base material:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206: 2013 + A2: 2021.
- Strength classes C12/15 to C50/60 according to EN 206: 2013 + A2: 2021 for static and quasi static loading and under fire exposure.
- Maximum chloride content of 0,40 % (CL 0.40) related to the cement content according to EN 206: 2013 + A2: 2021.
- Non-carbonated concrete.

Note: In case of a carbonated surface of the existing concrete structure the carbonated layer shall be removed around the post-installed rebar connection with a diameter of  $\phi + 60$  mm prior to the installation of the new rebar. The depth of concrete to be removed shall correspond to at least the minimum concrete cover in accordance with EN 1992-1-1: 2004 + A1: 2014. The foregoing may be neglected if building components are new and not carbonated and if building components are in dry conditions.

#### Temperature in the base material:

- **at installation**  
-5 °C to +40 °C
- **in-service**  
-40 °C to +80 °C (max. long term temperature +50 °C and max. short term temperature +80 °C)

#### Use conditions for HZA(-R) (Environmental conditions):

- Structures subject to dry internal conditions (all materials).
- For all other conditions according EN 1993-1-4: 2006 + A2: 2020 corresponding to corrosion resistance classes Annex A6, Table A1 (stainless steels).

#### Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the forces to be transmitted.
- Design of Hilti Tension anchor part embedded in the concrete under static or quasi static loading in accordance with EN 1992-1-1: 2004 + A1: 2014.
- Design of Hilti Tension anchor part extending above the concrete surface for steel failure under static or quasi static tension load in accordance with EN 1992-4: 2018.
- Design under fire exposure in accordance with EN 1992-1-2: 2004 + A1: 2019 and for Hilti Tension anchor in addition in accordance with EN 1992-4: 2018, Annex D.
- The actual position of the reinforcement in the existing structure shall be determined based on the construction documentation and considered when designing.

## **ANNEX B2**

### **Intended use, Specifications**

This annex applies to the product described in the main body of the UK Technical Assessment.

#### **Installation:**

- Use category: dry or wet concrete (not in flooded holes).
- Drilling technique:
  - hammer drilling,
  - hammer drilling with Hilti hollow drill bit TE-CD, TE-YD,
  - compressed air drilling,
  - diamond coring (dry/wet),
  - diamond coring with roughening with Hilti Roughening tool TE-YRT.
- Overhead installation is admissible.
- Rebar installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Check the position of the existing rebars (if the position of existing rebars is not known, it shall be determined using a rebar detector suitable for this purpose as well as since the construction documentation and then marked on the building component for the overlap joint).

## ANNEX B3

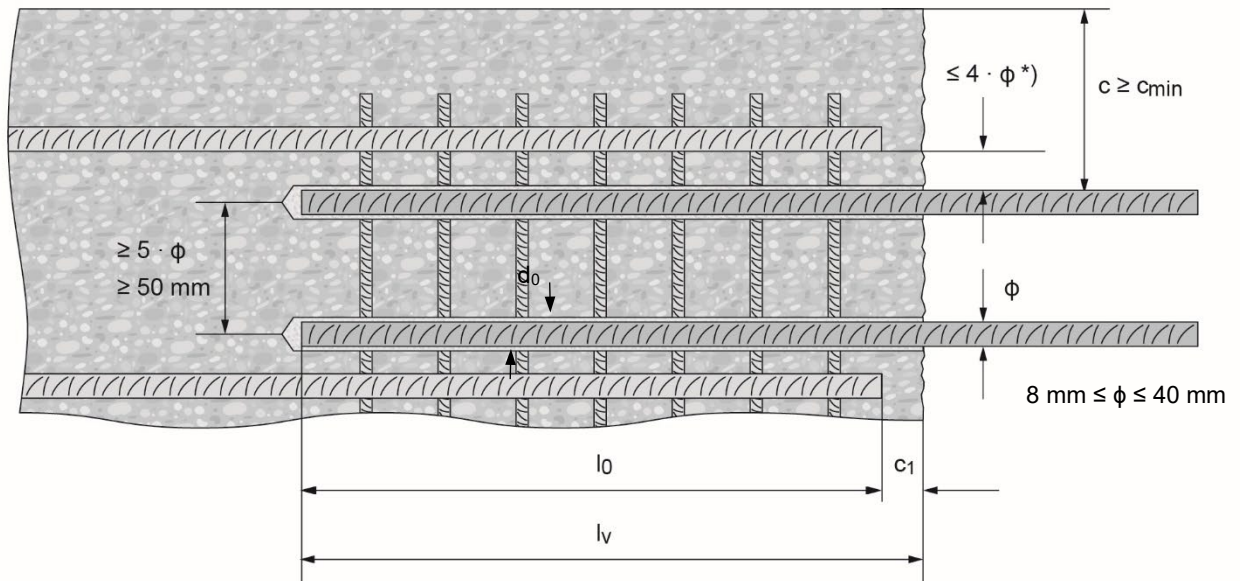
### Intended use

#### General construction rules for post-installed rebar

This annex applies to the product described in the main body of the UK Technical Assessment.

#### Figure B1: General construction rules for post-installed rebar

- Post-installed rebar may be designed for tension forces only.
- The transfer of shear forces between new concrete and existing structure shall be designed additionally according to EN 1992-1-1: 2004 + A1: 2014.
- The joints for concreting must be roughened to at least such an extent that aggregate protrudes.



\*) If the clear distance between lapped bars exceeds  $4 \cdot \phi$ , then the lap length shall be increased by the difference between the clear bar distance and  $4 \cdot \phi$ .

c concrete cover of post-installed rebar

$c_1$  concrete cover at end-face of existing rebar

$c_{min}$  minimum concrete cover according to Table B3 and to EN 1992-1-1: 2004 + A1: 2014

$\phi$  diameter of reinforcement bar

$l_0$  lap length, according to EN 1992-1-1: 2004 + A1: 2014 for static loading

$l_v$  embedment length  $\geq l_0 + c_1$

$d_0$  nominal drill bit diameter

## ANNEX B4

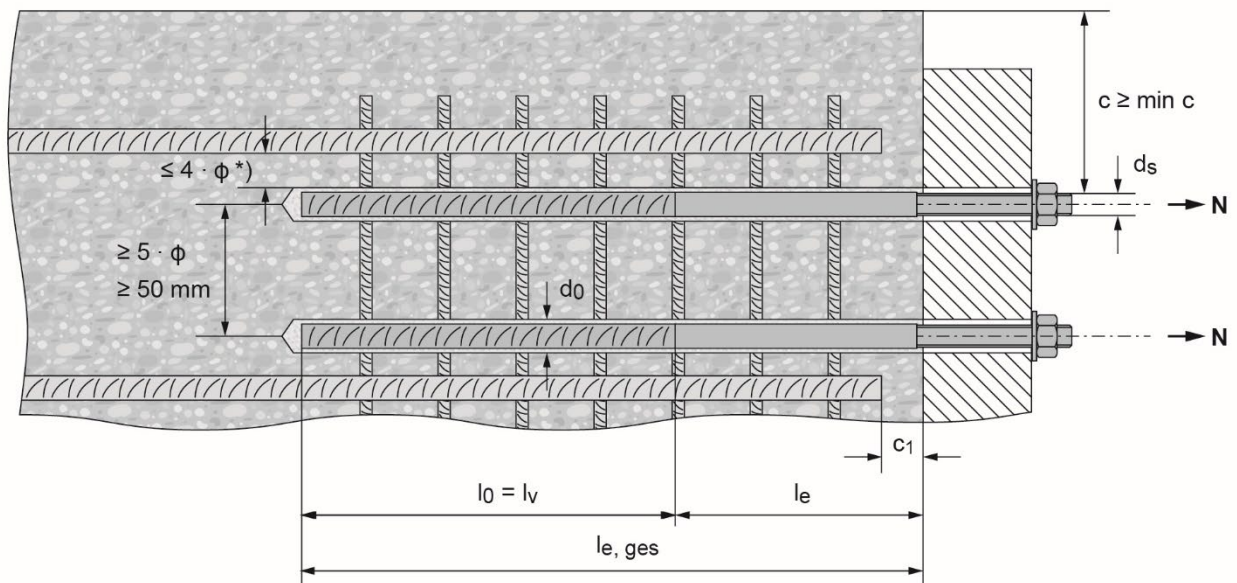
### Intended use

#### General construction rules for HZA / HZA-R

This annex applies to the product described in the main body of the UK Technical Assessment.

#### Figure B2: General construction rules for Hilti tension anchor HZA / HZA-R

- Hilti tension anchor HZA / HZA-R may be designed for tension forces only.
- The tension forces must be transferred via an overlap joint to the reinforcement in the existing structure.
- The length of the bonded-in smooth shaft may not be accounted as anchorage.
- The transfer of shear forces shall be ensured by appropriate additional measures, e.g., by shear lugs or by anchors with a UK Technical Assessment (UKTA).
- In the anchor plate the holes for the Hilti tension anchor shall be executed as elongated holes with the axis in the direction of the shear force.



\*) If the clear distance between lapped bars exceeds  $4 \cdot \phi$ , then the lap length shall be increased by the difference between the clear bar distance and  $4 \cdot \phi$ .

$c$  concrete cover of Hilti tension anchor HZA / HZA-R

$c_1$  concrete cover at end-face of existing rebar

$c_{\min}$  minimum concrete cover according to Table B3 and to EN 1992-1-1: 2004 + A1: 2014

$\phi$  diameter of reinforcement bar

$l_0$  lap length, according to EN 1992-1-1: 2004 + A1: 2014

$l_v$  embedment length

$l_e$  length of the smooth shaft or the bonded-in threaded part

$l_{e, \text{ges}}$  overall embedment length

$d_0$  nominal drill bit diameter

## ANNEX B5

### Intended use

#### Dimensions for HZA and HZA-R / Minimum concrete cover $c_{min}$

This annex applies to the product described in the main body of the UK Technical Assessment.

**Table B1: Hilti tension anchor HZA-R, dimensions**

Hilti tension anchor HZA-R			M12	M16	M20	M24
Rebar diameter	$\phi$	[mm]	12	16	20	25
Overall embedment length and drill hole depth	$l_{e,ges}$	[mm]	170 to 800	180 to 1300	190 to 1300	200 to 1300
Embedment length ( $l_v = l_{e,ges} - l_e$ )	$l_v$	[mm]	$l_{e,ges} - 100$			
Length of smooth shaft	$l_e$	[mm]	100			
Nominal diameter of drill bit	$d_0$	[mm]	16	20	25	32
Maximum diameter of clearance hole in the fixture	$d_f$	[mm]	14	18	22	26
Maximum installation torque	max. $T_{inst}$	[Nm]	40	80	150	200

**Table B2: Hilti tension anchor HZA, dimensions**

Hilti tension anchor HZA			M12	M16	M20	M24	M27
Rebar diameter	$\phi$	[mm]	12	16	20	25	28
Overall embedment length and drill hole depth	$l_{e,ges}$	[mm]	90 to 800	100 to 1300	110 to 1300	120 to 1300	140 to 1300
Embedment length ( $l_v = l_{e,ges} - l_e$ )	$l_v$	[mm]	$l_{e,ges} - 20$				
Length of smooth shaft	$l_e$	[mm]	20				
Nominal diameter of drill bit	$d_0$	[mm]	16	20	25	32	35
Maximum diameter of clearance hole in the fixture	$d_f$	[mm]	14	18	22	26	30
Maximum installation torque	max. $T_{inst}$	[Nm]	40	80	150	200	270

**Table B3: Minimum concrete cover  $c_{min}^{1)}$  of the post-installed rebar or tension anchor HZA(-R) depending on drilling method and drilling tolerance**

Drilling method	Rebar diameter [mm]	Minimum concrete cover $c_{min}^{1)}$ [mm]	
		Without drilling aid <sup>2)</sup>	With drilling aid <sup>2)</sup>
Hammer drilling and hammer drilling with Hilti hollow drill bit TE-CD, TE-YD	$\phi < 25$	$30 + 0,06 \cdot l_v \geq 2 \cdot \phi$	$30 + 0,02 \cdot l_v \geq 2 \cdot \phi$
	$\phi \geq 25$	$40 + 0,06 \cdot l_v \geq 2 \cdot \phi$	$40 + 0,02 \cdot l_v \geq 2 \cdot \phi$
Compressed air drilling	$\phi < 25$	$50 + 0,08 \cdot l_v$	$50 + 0,02 \cdot l_v$
	$\phi \geq 25$	$60 + 0,08 \cdot l_v \geq 2 \cdot \phi$	$60 + 0,02 \cdot l_v \geq 2 \cdot \phi$
Diamond coring (wet/dry)	$\phi < 25$	Drill stand works like a drilling aid	$30 + 0,02 \cdot l_v \geq 2 \cdot \phi$
	$\phi \geq 25$		$40 + 0,02 \cdot l_v \geq 2 \cdot \phi$
Diamond coring with roughening with Hilti Roughening tool TE-YRT	$\phi < 25$	$30 + 0,06 \cdot l_v \geq 2 \cdot \phi$	$30 + 0,02 \cdot l_v \geq 2 \cdot \phi$
	$\phi \geq 25$	$40 + 0,06 \cdot l_v \geq 2 \cdot \phi$	$40 + 0,02 \cdot l_v \geq 2 \cdot \phi$

<sup>1)</sup> See Annexes B2 and B3, Figures B1 and B2.

Comments: The minimum concrete cover acc. EN 1992-1-1: 2004 + A1: 2014.

<sup>2)</sup> For HZA(-R)  $l_{e,ges}$  instead of  $l_v$ .

## ANNEX B6

### Intended use

#### Maximum embedment length / Working time and curing time

This annex applies to the product described in the main body of the UK Technical Assessment.

**Table B4: Maximum embedment length  $l_{v,max}^{1)}$  depending on rebar diameter and dispenser**

Element		Dispensers		
Rebar	Hilti tension anchor	HDM 330, HDM 500	HDE 500	HIT-P8000D
Size	Size	$l_{v,max}^{1)}$ [mm]	$l_{v,max}^{1)}$ [mm]	$l_{v,max}^{1)}$ [mm]
φ 8	-	1000	1000	-
φ 10	-		1000	-
φ 12	HZA(-R) M12		1200	1200
φ 13	-		1300	1300
φ 14	-		1400	1400
φ 16	HZA(-R) M16		1600	1600
φ 18	-		700	1800
φ 20	HZA(-R) M20	600	2000	2000
φ 22	-	500	1800	2200
φ 24	-	300	1300	2400
φ 25	HZA(-R) M24	300	1500	2500
φ 26	-	300	1000	2600
φ 28	HZA M27	300	1000	2800
φ 30	-	-	1000	3000
φ 32	-		700	3200
φ 34	-		600	
φ 36	-		600	
φ 40	-		400	

<sup>1)</sup> For HZA(-R)  $l_{e,ges,max}$  instead of  $l_{v,max}$ .

**Table B5: Working time and curing time<sup>1) 2)</sup>**

Temperature in the base material T		Maximum working time $t_{work}$	Initial curing time $t_{cure,ini}$	Minimum curing time $t_{cure}$
-5 °C	to -1 °C	2 hours	48 hours	168 hours
0 °C	to 4 °C	2 hours	24 hours	48 hours
5 °C	to 9 °C	2 hours	16 hours	24 hours
10 °C	to 14 °C	1,5 hours	12 hours	16 hours
15 °C	to 19 °C	1 hour	8 hours	16 hours
20 °C	to 24 °C	30 min	4 hours	7 hours
25 °C	to 29 °C	20 min	3,5 hours	6 hours
30 °C	to 34 °C	15 min	3 hours	5 hours
35 °C	to 39 °C	12 min	2 hours	4,5 hours
40 °C		10 min	2 hours	4 hours

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

<sup>2)</sup> The minimum temperature of the foil pack is +5° C.

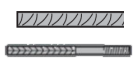





## ANNEX B7

### Intended use

#### Parameters of drilling, cleaning, and setting tools Hammer drilling and compressed air drilling

This annex applies to the product described in the main body of the UK Technical Assessment.

**Table B6: Parameters of drilling, cleaning, and setting tools  
hammer drilling and compressed air drilling**

Element	Drill and clean					Installation		
	Hammer drilling	Compressed air drilling	Brush HIT-RB	Air nozzle HIT-DL	Extension for air nozzle	Piston plug HIT-SZ	Extension for piston plug	Maximum embedment length
								-
size	d <sub>0</sub> [mm]	d <sub>0</sub> [mm]	size	size	[-]	size	[-]	l <sub>v,max</sub> <sup>2)</sup> [mm]
φ 8	10	-	10	10	HIT-DL 10/0,8 or HIT-DL V10/1	-	HIT-VL 9/1,0	250
	12	-	12	12		12		1000
φ 10	12	-	12	12		12	HIT-VL 11/1,0	1000
	14	-	14	14		14		1000
φ 12	14	-	14	14		14		1200
φ 12 / HZA(-R) M12	16	-	16	16		16		1200
φ 12	-	17	18	16		16		1300
φ 13	16	-	16	16		16		1400
	-	17	18	16		16		
φ 14	18	-	18	18		18		
	-	17	18	16		16		
φ 16 / HZA(-R) M16	20	20	20	20		HIT-DL 16/0,8 or HIT-DL B and/or HIT-VL 16/0,7 and/or HIT-VL 16		20
φ 18	22	22	22	22	22		1800	
φ 20 / HZA(-R) M20	25	-	25	25	25		2000	
	-	26	28	25	25			
φ 22	28	28	28	28	28		2200	
φ 24	30	30	30	30	30		1000	
	32	32	32	32	32			
φ 25 / HZA(-R) M24	30	30	30	30	30		2500	
	32	32	32	32	32			
φ 26	35	35	35	32	35		2600	
φ 28 / HZA M27	35	35	35	32	35		2800	
φ 30	-	35	35	32	35		3000	
	37	37	37	32	37			
φ 32	40	40	40	32	40		3200	
φ 34	-	42	42	32	42		3200	
	45	-	45	32	45			
φ 36	45	45	45	32	45	3200		
φ 40	55	-	55	32	55	3200		
	-	57	55	32	55			

<sup>1)</sup> Assemble extension HIT-VL 16/0,7 with coupler HIT-VL K for deeper drill holes.

<sup>2)</sup> For HZA(-R) l<sub>e,ges,max</sub> instead of l<sub>v,max</sub>.



## ANNEX B8

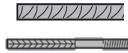







### Intended use

#### Parameters of drilling, cleaning, and setting tools

#### Hammer drilling with Hilti hollow drill bit and diamond coring (dry)

This annex applies to the product described in the main body of the UK Technical Assessment.

**Table B7: Parameters of drilling, cleaning, and setting tools  
hammer drilling with Hilti hollow drill bit and diamond coring (dry)**

Element	Drill and clean					Installation		
	Hammer-drilling with hollow drill bit <sup>3)</sup>	Diamond coring (dry)	Brush HIT-RB	Air nozzle HIT-DL	Extension for air nozzle	Piston plug HIT-SZ	Extension for piston plug	Maximum embedment length
								-
Size	d <sub>0</sub> [mm]	d <sub>0</sub> [mm]	Size	Size	[-]	Size	[-]	l <sub>v,max</sub> <sup>4)</sup> [mm]
φ 10	12	-	No cleaning required.			12	HIT-VL 9/1,0	1000
	14	-				14	HIT-VL 11/1,0	1000
φ 12	14	-				14		1000
φ 12 / HZA(-R) M12	16	-				16		1000
φ 13	16	-				16		1000
φ 14	18	-				18	1000	
φ 16 / HZA(-R) M16	20	-				20	HIT-VL 16/0,7 and/or HIT-VL 16	1000
φ 18	22	-				22		1000
φ 20 / HZA(-R) M20	25	-				25		1000
φ 22	28	-				28		1000
φ 24	32	-				32		1000
	-	35				35		2400
φ 25 / HZA(-R) M24	32	-				32		1000
	-	35				35		2500
φ 26	35	35				35		1000 <sup>2)</sup> / 2600
φ 28 / HZA M27	35	35				35		1000 <sup>2)</sup> / 2800
φ 30	-	35				35	3000	
φ 32	-	40				40	3200	
φ 34	-	42				42	3200	
	-	45				45	3200	
φ 36	-	47	47	3200				
φ 40	-	52	52	3200				

1) Assemble extension HIT-VL 16/0,7 with coupler HIT-VL K for deeper drill holes.

2) Maximum embedment length for use with Hilti hollow drill bit TE-CD / TE-YD.

3) With vacuum cleaner Hilti VC 20/40/60 (automatic filter cleaning activated) or vacuum cleaner with activated automatic filter cleaning as well as volumetric flow rate at turbine  $\geq 57 \text{ l}\cdot\text{s}^{-1}$ , volumetric flow rate at end of hose  $\geq 106 \text{ m}^3\cdot\text{h}^{-1}$  and partial vacuum  $\geq 16 \text{ kPa}$ .

4) For HZA(-R) l<sub>e,ges,max</sub> instead of l<sub>v,max</sub>.

## ANNEX B9

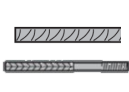

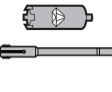





### Intended use

#### Parameters of drilling, cleaning, and setting tools

#### Diamond coring (wet) and diamond coring with roughening

This annex applies to the product described in the main body of the UK Technical Assessment.

**Table B8: Parameters of drilling, cleaning, and setting tools  
diamond coring (wet) and diamond coring with roughening**

Element	Drill and clean					Installation			
	Diamond coring (wet)	Diamond coring with roughening	Brush HIT-RB	Air nozzle HIT-DL	Extension for air nozzle	Piston plug HIT-SZ	Extension for piston plug	Maximum embedment length	
								-	
Size	d <sub>0</sub> [mm]	d <sub>0</sub> [mm]	Size	Size	[-]	Size	[-]	l <sub>v,max</sub> <sup>3)</sup> [mm]	
φ 8	10	-	10	10	HIT-DL 10/0,8 or HIT-DL V10/1	-	HIT-VL 9/1,0	250	
	12	-	12	12		12		1000	
φ 10	12	-	12	12		12		1000	
	14	-	14	14		14	1000		
φ 12	14	-	14	14		14	1000		
φ 12 / HZA(-R) M12	16	-	16	16		16	HIT-VL 11/1,0	1200	
φ 13	16	-	16	16		16		1300	
φ 14	18	18	18	18		18		1400 / 900 <sup>2)</sup>	
φ 16 / HZA(-R) M16	20	20	20	20		HIT-DL 16/0,8 or HIT-DL B and/or HIT-VL 16/0,7 and/or HIT-VL 16	20	HIT-VL 16/0,7 and/or HIT-VL 16	1600 / 1000 <sup>2)</sup>
φ 18	22	22	22	22			22		1800 / 1200 <sup>2)</sup>
φ 20 / HZA(-R) M20	25	25	25	25	25		2000 / 1300 <sup>2)</sup>		
φ 22	28	28	28	28	28		2200 / 1400 <sup>2)</sup>		
	30	30	30	30	30		1000		
φ 24	32	32	32	32	32		2400 / 1600 <sup>2)</sup>		
	30	30	30	30	30		1000		
φ 25 / HZA(-R) M24	32	32	32	32	32		2500 / 1600 <sup>2)</sup>		
	35	35	35	32	35		2600 / 1800 <sup>2)</sup>		
φ 28 / HZA M27	35	35	35	32	35		2800 / 1800 <sup>2)</sup>		
φ 30	37	-	37	32	37	3000			
φ 32	40	-	40	32	40	3200			
φ 34	42	-	42	32	42	3200			
	45	-	45	32	45				
φ 36	47	-	47	32	47	3200			
φ 40	52	-	52	32	52	3200			

1) Assemble extension HIT-VL 16/0,7 with coupler HIT-VL K for deeper drill holes.

2) Maximum embedment length for use with Hilti Roughening tool TE-YRT.





3) For HZA(-R) l<sub>e,ges,max</sub> instead of l<sub>v,max</sub>.

## ANNEX B10

### Intended use Cleaning alternatives

This annex applies to the product described in the main body of the UK Technical Assessment.

**Table B9: Cleaning alternatives**

<p><b>Automatic Cleaning (AC):</b> Cleaning is performed during drilling with Hilti hollow drill bit TE-CD, TE-YD including vacuum cleaner.</p>	
<p><b>Compressed Air Cleaning (CAC):</b> air nozzle with an orifice opening of minimum 3,5 mm in diameter. + brush HIT-RB</p>	
<p><b>Manual Cleaning (MC):</b> Hilti hand pump + brush HIT-RB for cleaning of drill holes with diameters <math>d_0 \leq 20</math> mm and drill hole depths <math>\leq 10 \cdot \phi</math>.</p>	
<p><b>Compressed Air without brushing (C):</b> air nozzle with an orifice opening of minimum 3,5 mm in diameter. for cleaning of drill holes with diameters <math>d_0 \leq 32</math> mm.</p>	




## ANNEX B11

### Intended use

#### Parameters for use of Hilti Roughening tool

This annex applies to the product described in the main body of the UK Technical Assessment.

**Table B10: Parameters for use of the Hilti Roughening tool TE-YRT**

Diamond coring		Roughening tool TE-YRT	Wear gauge RTG...
			
d <sub>0</sub>			
nominal [mm]	measured [mm]	d <sub>0</sub> [mm]	size
18	17,9 to 18,2	18	18
20	19,9 to 20,2	20	20
22	21,9 to 22,2	22	22
25	24,9 to 25,2	25	25
28	27,9 to 28,2	28	28
30	29,9 to 30,2	30	30
32	31,9 to 32,2	32	32
35	34,9 to 35,2	35	35

**Table B11: Installation parameters for use of the Hilti Roughening tool TE-YRT**

l <sub>v</sub> <sup>1)</sup> [mm]	Roughening time t <sub>roughen</sub> (t <sub>roughen</sub> [sec] = l <sub>v</sub> <sup>1)</sup> [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

<sup>1)</sup> For HZA(-R) l<sub>e,ges</sub> instead of l<sub>v</sub>.

**Table B12: Hilti Roughening tool TE-YRT and wear gauge RTG**



## ANNEX B12

### Intended use Installation instruction

This annex applies to the product described in the main body of the UK Technical Assessment.

#### Installation instruction

##### Safety Regulations:

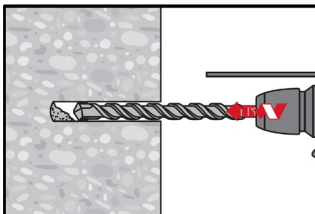


Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling!  
Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-RE 500 V4.  
Important: Observe the installation instruction provided with each foil pack.

##### Hole drilling

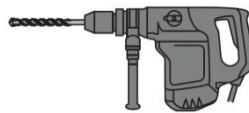
Before drilling remove carbonized concrete and clean contact areas (see Annex B1).  
In case of aborted drill hole the drill hole shall be filled with mortar.

##### a) Hammer drilling

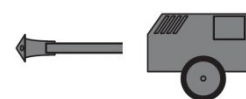


Drill hole to the required embedment length with a hammer drill set in rotation-hammer mode or a compressed air drill using an appropriately sized carbide drill bit.

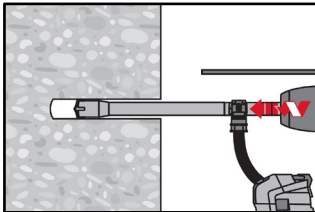
Hammer drill



Compressed air drill

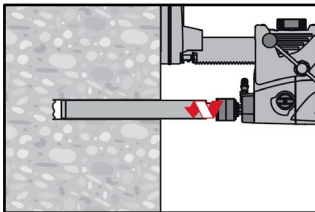


##### b) Hammer drilling with Hilti hollow drill bit TE-CD, TE-YD



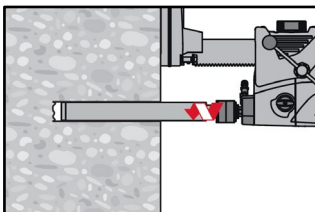
Drill hole to the required embedment length with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit attached to Hilti vacuum cleaner VC 20/40/60 or a vacuum cleaner acc. to Table B7 with automatic filter cleaning activated. This drilling system removes the dust and cleans the drill hole during drilling when used in accordance with the user's manual. After drilling is completed, proceed to the "injection preparation" step in the installation instruction.

##### c) Diamond coring



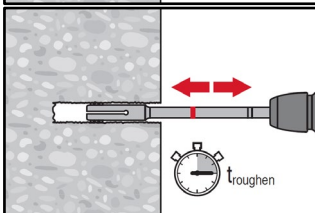
Diamond coring is permissible when suitable diamond core drilling machines and the corresponding core bits are used.

##### d) Diamond coring with roughening with Hilti Roughening tool TE-YRT



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

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



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

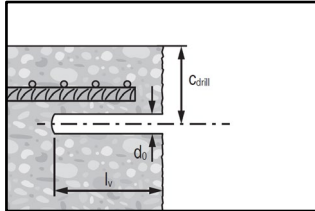
Roughen the drill hole over the whole length to the required  $l_v$  or  $l_{e,ges}$ .

## ANNEX B13

### Intended use Installation instruction

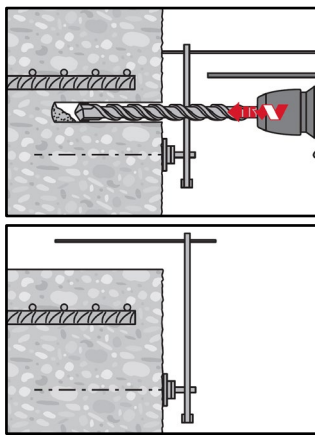
This annex applies to the product described in the main body of the UK Technical Assessment.

#### Splicing applications



Measure and control concrete cover  $c$ .  
 $c_{\text{drill}} = c + d_0/2$ .  
Drill parallel to surface edge and to existing rebar.  
Where applicable use Hilti drilling aid HIT-BH.

**Drilling aid:** for drill holes depths > 20 cm use drilling aid.

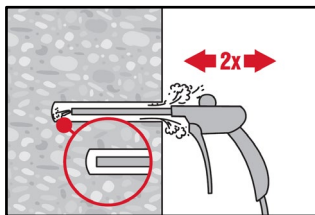


Ensure that the drill hole is parallel to the existing rebar.  
Three different options can be considered:

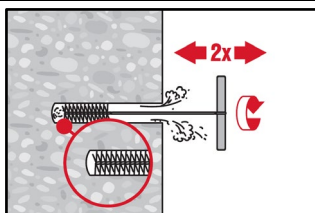
- Hilti drilling aid HIT-BH
- Lath or spirit level
- Visual check

**Drill hole cleaning:** just before setting the bar the drill hole must be free of dust and debris.  
Inadequate hole cleaning = poor load values.

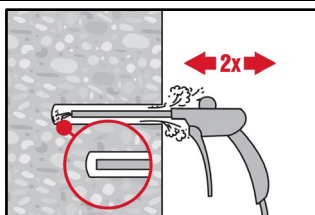
**Compressed Air Cleaning (CAC)** for hammer drilled holes:  
for all drill hole diameters  $d_0$  and all drill hole depths  $\leq 20 \cdot \phi$ .



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



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



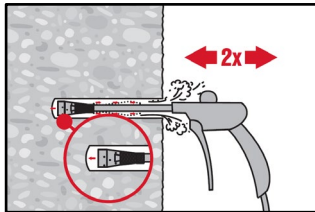
Blow again with compressed air 2 times until return air stream is free of noticeable dust.

## ANNEX B14

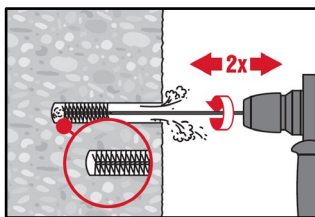
### Intended use Installation instruction

This annex applies to the product described in the main body of the UK Technical Assessment.

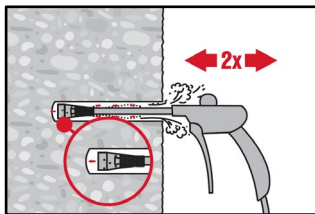
**Compressed Air Cleaning (CAC)** for hammer drilled holes:  
for drill holes deeper than 250 mm (for  $\phi 8$  to  $\phi 12$ ) or deeper than  $20 \cdot \phi$  (for  $\phi > 12$  mm)



Use the appropriate air nozzle Hilti HIT-DL (see Table B6).  
Blow 2 times from the back of the hole over the whole length with oil-free compressed air until return air stream is free of noticeable dust.  
Safety tip:  
Do not inhale concrete dust.

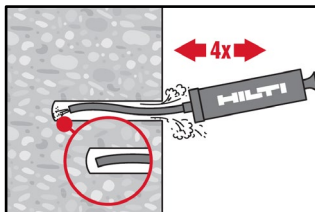


Screw the round steel brush HIT-RB in one end of the brush extension(s) HIT-RBS, so that the overall length of the brush is sufficient to reach the base of the drill hole. Attach the other end of the extension to the TE-C/TE-Y chuck.  
Safety tip:  
Start machine brushing operation slowly.  
Start brushing operation once the brush is inserted in the drill hole.

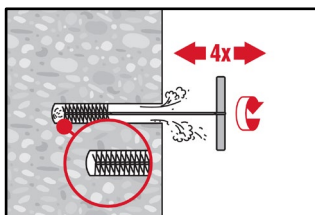


Use the appropriate air nozzle Hilti HIT-DL (see Table B6).  
Blow 2 times from the back of the hole over the whole length with oil-free compressed air until return air stream is free of noticeable dust.  
Safety tip:  
Do not inhale concrete dust.

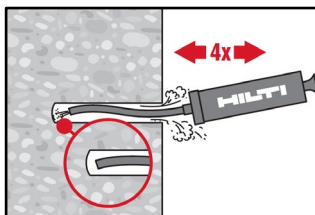
**Manual Cleaning (MC)** for hammer drilled holes:  
for drill hole diameters  $d_0 \leq 20$  mm and all drill hole depths  $\leq 10 \cdot \phi$ .



The Hilti hand pump may be used for blowing out drill holes up to diameters  $d_0 \leq 20$  mm and drill hole depths  $\leq 10 \cdot \phi$ .  
Blow out at least 4 times from the back of the drill hole until return air stream is free of noticeable dust.



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



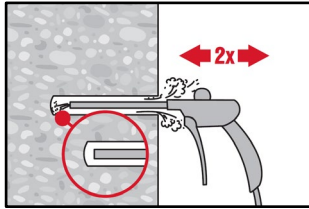
Blow again with the Hilti hand pump at least 4 times until return air stream is free of noticeable dust.

## ANNEX B15

### Intended use Installation instruction

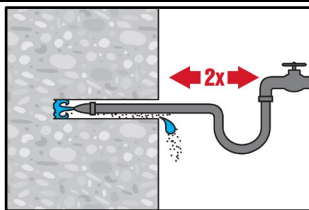
This annex applies to the product described in the main body of the UK Technical Assessment.

#### Compressed Air without brushing: for hammer drilled holes: For drill hole diameters $d_0 \leq 32$ mm

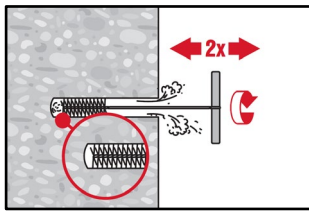


Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m<sup>3</sup>/h) until return air stream is free of noticeable dust.

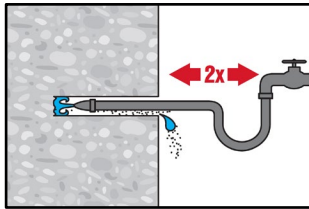
#### Cleaning of diamond cored holes: for all drill hole diameters $d_0$ and all drill hole depths



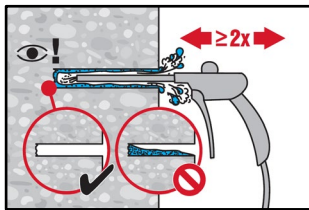
Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



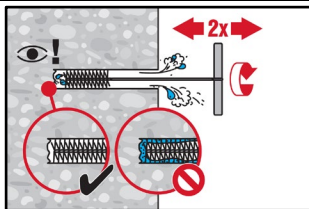
Brush 2 times with the specified brush (see Table B8) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.  
The brush must produce natural resistance as it enters the drill hole (brush  $\varnothing \geq$  drill hole  $\varnothing$ ) - if not the brush is too small and must be replaced with the proper brush diameter.



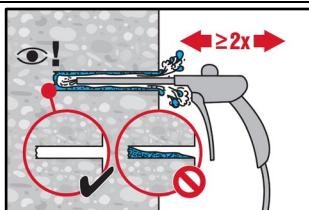
Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m<sup>3</sup>/h) until return air stream is free of noticeable dust and water.  
For drill hole diameters  $\geq 32$  mm the compressor has to supply a minimum air flow of 140 m<sup>3</sup>/h.



Brush 2 times with the specified brush size (brush  $\varnothing \geq$  drill hole  $\varnothing$ , see Table B8) 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.

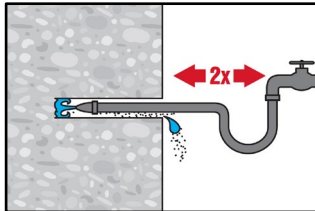


## ANNEX B16

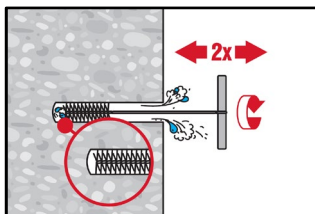
### Intended use Installation instruction

This annex applies to the product described in the main body of the UK Technical Assessment.

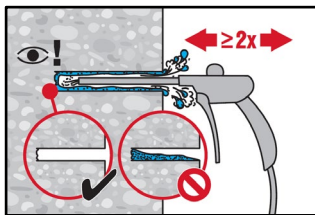
#### Cleaning of diamond cored holes with roughening with Hilti Roughening tool TE-YRT: for all drill hole diameters $d_0$ and all drill hole depths



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

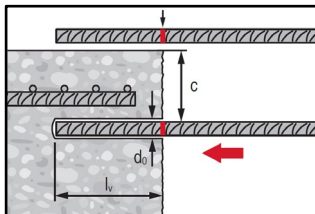


Brush 2 times with the specified brush (see Table B8) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.  
The brush must produce natural resistance as it enters the drill hole (brush  $\varnothing \geq$  drill hole  $\varnothing$ ) - if not the brush is too small and must be replaced with the proper brush diameter.



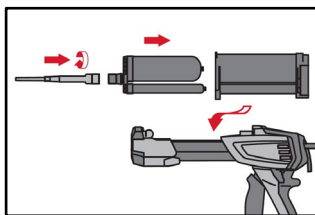
Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m<sup>3</sup>/h) until return air stream is free of noticeable dust and water.  
For drill hole diameters  $\geq 32$  mm the compressor must supply a minimum air flow of 140 m<sup>3</sup>/h.

#### Rebar preparation

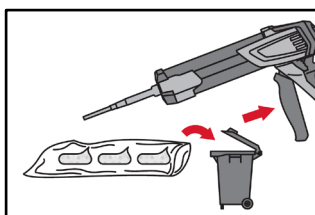


Before use, make sure the rebar is dry and free of oil or another residue.  
Mark the embedment length on the rebar (e.g. with tape)  $\rightarrow l_v$  or  $l_{e,ges}$ .  
Insert rebar in drill hole to verify hole depth and embedment length  $l_v$  or  $l_{e,ges}$ .

#### 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 must 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.

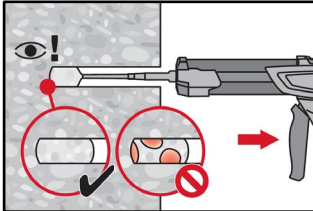
## ANNEX B17

### Intended use Installation instruction

This annex applies to the product described in the main body of the UK Technical Assessment.

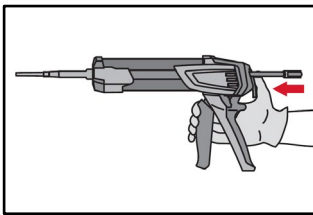
**Inject adhesive:** inject adhesive from the back of the drill hole without forming air voids.

#### Injection method for drill hole depths $\leq 250$ mm (without overhead applications)



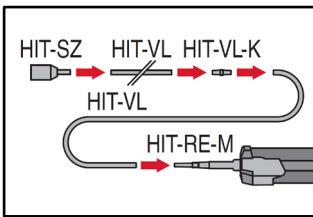
Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull.

Fill approximately 2/3 of the drill hole to ensure that the annular gap between the anchor and the concrete is 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.

#### Injection method for drill hole depths $> 250$ mm or overhead applications

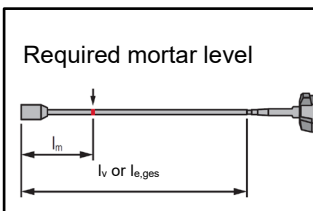


Assemble mixing nozzle HIT-RE-M, extension(s) and piston plug HIT-SZ (see Table B6, B7 or B8).

For combinations of several injection extensions use coupler HIT-VL-K.

A substitution of the injection extension for a plastic hose or a combination of both is permitted.

The combination of HIT-SZ piston plugs with HIT-VL 16 pipe and then HIT-VL 16 tube support proper injection.



Mark the required mortar level  $l_m$  and embedment length  $l_v$  or  $l_{e,ges}$  with tape or marker on the injection extension.

Estimation:

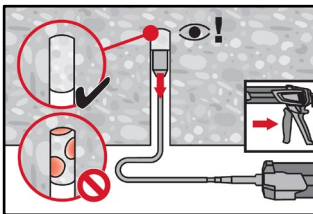
$$l_m = 1/3 \cdot l_v \text{ for rebar,}$$

$$l_m = 1/3 \cdot l_{e,ges} \text{ for HZA(-R).}$$

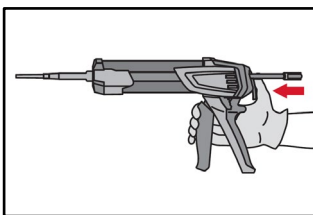
Precise formula for optimum mortar volume:

$$l_m = l_v \cdot (1,2 \cdot (\phi^2 / d_0^2) - 0,2) \text{ for rebar,}$$

$$l_m = l_{e,ges} \cdot (1,2 \cdot (\phi^2 / d_0^2) - 0,2) \text{ for HZA(-R).}$$



For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug (see Table B6, B7 or B8). 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.



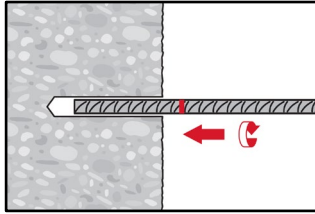
After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

## ANNEX B18

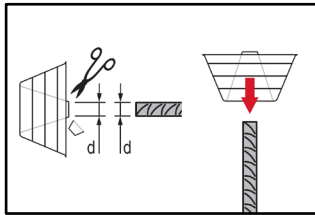
### Intended use Installation instruction

This annex applies to the product described in the main body of the UK Technical Assessment.

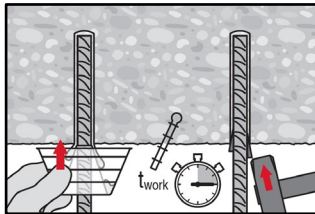
**Setting the element:** before use, verify that the element is dry and free of oil and other contaminants.



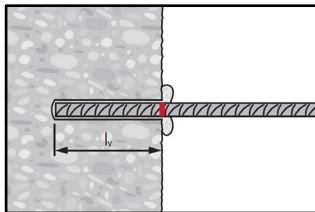
For easy installation insert the rebar into the drill hole while slowly twisting until the embedment mark is at the concrete surface level.



For overhead application:  
During insertion of the rebar mortar might flow out of the drill hole. For collection of the flowing mortar overhead dripping cup HIT-OHC may be used.

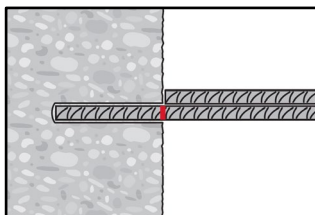


Support the rebar and secure it from falling until mortar has started to harden, e.g., using wedges HIT-OHW.

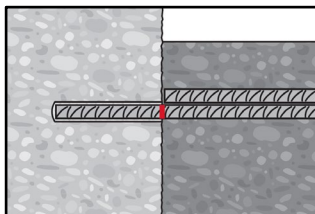


After installing the rebar, the annular gap must be completely filled with mortar.  
Proper installation:

- desired anchoring embedment  $l_v$  or  $l_{e,ges}$  is reached: embedment mark at concrete surface.
- excess mortar flows out of the drill hole after the rebar has been fully inserted until the embedment mark.



Observe the working time  $t_{work}$  (see Table B5), which varies according to temperature of base material. Minor adjustments to the rebar position may be performed during the working time.



Full load may be applied only after the curing time  $t_{cure}$  has elapsed (see Table B5).

## ANNEX C1

### Performance

#### Essential characteristics under static and quasi-static loading

This annex applies to the product described in the main body of the UK Technical Assessment.

#### Essential characteristics under static and quasi-static loading

Minimum anchorage length, minimum lap length and design values of the bond strength for a working life of 50 and 100 years for following drilling techniques:

- hammer drilling,
- hammer drilling with Hilti hollow drill bit TE-CD, TE-YD,
- compressed air drilling,
- diamond coring (dry),
- diamond coring with roughening with Hilti Roughening tool TE-YRT.

The minimum anchorage length  $l_{b,min}$  and the minimum lap length  $l_{0,min}$  according to EN 1992-1-1: 2004 + A1: 2014 shall be multiplied by the amplification factor  $\alpha_{lb} = \alpha_{lb,100y}$  given in Table C1.

The design values of the bond strength  $f_{bd,PIR}$  and  $f_{bd,PIR,100y}$  are given in Table C3. It is obtained by multiplying the design value of the bond strength  $f_{bd}$  according to EN 1992-1-1: 2004 + A1: 2014 (Eq. 8.3) by the bond efficiency factor  $k_b = k_{b,100y}$  according to Table C2.

**Table C1: Amplification factor  $\alpha_{lb}$  and  $\alpha_{lb,100y}$**

Rebar diameter	Amplification factor $\alpha_{lb} = \alpha_{lb,100y}$ [-]								
	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
$\phi$ 8 to $\phi$ 40	1,0								

**Table C2: Bond efficiency factor  $k_b$  and  $k_{b,100y}$**

Rebar diameter	Bond efficiency factor $k_b = k_{b,100y}$ [-]								
	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
$\phi$ 8 to $\phi$ 40	1,0								

**Table C3: Design values of the bond strength  $f_{bd,PIR}$ <sup>1)</sup> and  $f_{bd,PIR,100y}$ <sup>1)</sup>**

Rebar diameter	Bond strength $f_{bd,PIR} = f_{bd,PIR,100y}$ [N·mm <sup>-2</sup> ]								
	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
$\phi$ 8 to $\phi$ 32	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3
$\phi$ 34	1,6	2,0	2,3	2,6	2,9	3,3	3,6	3,9	4,2
$\phi$ 36	1,6	1,9	2,2	2,6	2,9	3,2	3,5	3,8	4,1
$\phi$ 40	1,5	1,8	2,1	2,5	2,8	3,1	3,4	3,7	3,9

<sup>1)</sup> According to EN 1992-1-1: 2004 + A1: 2014 for good bond conditions. For all other bond conditions multiply the values by 0,7.

## ANNEX C2

### Performance

#### Essential characteristics under static and quasi-static loading

This annex applies to the product described in the main body of the UK Technical Assessment.

#### Essential characteristics under static and quasi-static loading

Minimum anchorage length, minimum lap length and design values of the bond strength for a working life of 50 and 100 years for diamond coring (wet).

The minimum anchorage length  $l_{b,min}$  and the minimum lap length  $l_{0,min}$  according to EN 1992-1-1: 2004 + A1: 2014 shall be multiplied by the amplification factor  $\alpha_{lb} = \alpha_{lb,100y}$  given in Table C4.

The design values of the bond strength  $f_{bd,PIR}$  and  $f_{bd,PIR,100y}$  are given in Table C6. It is obtained by multiplying the design value of the bond strength  $f_{bd}$  according to EN 1992-1-1: 2004 + A1: 2014 (Eq. 8.3) by the bond efficiency factor  $k_b = k_{b,100y}$  according to Table C5.

**Table C4: Amplification factor  $\alpha_{lb}$  and  $\alpha_{lb,100y}$**

Rebar diameter	Amplification factor $\alpha_{lb} = \alpha_{lb,100y}$ [-]								
	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
$\phi$ 8 to $\phi$ 12	1,0								
$\phi$ 13 to $\phi$ 36	Linear interpolation between diameters								
$\phi$ 40	1,0			1,2		1,3		1,4	

**Table C5: Bond efficiency factor  $k_b$  and  $k_{b,100y}$**

Rebar diameter	Bond efficiency factor $k_b = k_{b,100y}$ [-]								
	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
$\phi$ 8 to $\phi$ 12	1,0								0,93
$\phi$ 13 and $\phi$ 16	1,0							0,93	0,86
$\phi$ 18 to $\phi$ 36	1,0					0,92		0,85	0,79
$\phi$ 40	1,0				0,90		0,82	0,76	0,71

**Table C6: Design values of the bond strength  $f_{bd,PIR}$ <sup>1)</sup> and  $f_{bd,PIR,100y}$ <sup>1)</sup>**

Rebar diameter	Bond strength $f_{bd,PIR} = f_{bd,PIR,100y}$ [N·mm <sup>-2</sup> ]								
	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
$\phi$ 8 to $\phi$ 12	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,0
$\phi$ 13 and $\phi$ 16	1,6	2,0	2,3	2,7	3,0	3,4	3,7	3,7	3,7
$\phi$ 18 to $\phi$ 32	1,6	2,0	2,3	2,7	3,0	3,4	3,4	3,4	3,4
$\phi$ 34	1,6	2,0	2,3	2,6	2,9	3,3	3,3	3,3	3,3
$\phi$ 36	1,6	1,9	2,2	2,6	2,9	3,2	3,2	3,2	3,2
$\phi$ 40	1,5	1,8	2,1	2,5	2,8	2,8	2,8	2,8	2,8

<sup>1)</sup> According to EN 1992-1-1: 2004 + A1: 2014 for good bond conditions. For all other bond conditions multiply the values by 0,7.

## ANNEX C3

### Performance

#### Essential characteristics under static and quasi-static loading

This annex applies to the product described in the main body of the UK Technical Assessment.

#### Essential characteristics under static and quasi-static loading

Tensile steel strength of Hilti tension anchor HZA and HZA-R

**Table C7: Characteristic tensile yield strength for rebar part of Hilti tension anchor HZA and HZA-R**

Hilti tension anchor HZA, HZA-R			M12	M16	M20	M24	M27
Rebar diameter	$\phi$	[mm]	12	16	20	25	28
Characteristic tensile yield strength	$f_{yk}$	[N/mm <sup>2</sup> ]	500	500	500	500	500 <sup>1)</sup>
Partial factor for rebar part	$\gamma_{Ms,N}^{2)}$	[-]	1,15				

1) HZA-R size M27 not available.

2) In absence of national regulations.

**Table C8: Characteristic tensile steel strength for threaded/smooth part of Hilti tension anchor HZA and HZA-R**

Hilti tension anchor HZA, HZA-R			M12	M16	M20	M24	M27
<b>Steel failure</b>							
Characteristic resistance HZA	$N_{Rk,s}$	[kN]	46	86	135	194	253
Characteristic resistance HZA-R	$N_{Rk,s}$	[kN]	62	111	173	248	<sup>1)</sup>
Partial factor for threaded part	$\gamma_{Ms,N}^{2)}$	[-]	1,4				

1) HZA-R size M27 not available.

2) In absence of national regulations.

## ANNEX C6

### Performance

#### Essential characteristics under fire exposure

This annex applies to the product described in the main body of the UK Technical Assessment.

#### Essential characteristics under fire exposure

Design value of the bond strength  $f_{bd,fi}$  for a working life of 50 years and design value of the bond strength  $f_{bd,fi,100y}$  for a working life of 100 years under fire exposure for concrete classes C12/15 to C50/60 for all drilling techniques.

The design values of the bond strength  $f_{bd,fi}$  and  $f_{bd,fi,100y}$  under fire exposure have to be calculated by the following equation:

$$f_{bd,fi} = k_{b,fi}(\theta) \cdot f_{bd,PIR} \cdot \frac{\gamma_c}{\gamma_{M,fi}} \quad \text{for a working life of 50 years}$$

$$f_{bd,fi,100y} = k_{b,fi,100y}(\theta) \cdot f_{bd,PIR,100y} \cdot \frac{\gamma_c}{\gamma_{M,fi}} \quad \text{for a working life of 100 years}$$

with  $\theta \leq 305^\circ \text{C}$ :  $k_{b,fi}(\theta) = \frac{651,24 \cdot \theta^{-1,115}}{f_{bd,PIR} \cdot 4,3} \leq 1,0$  for a working life of 50 years

$$k_{b,fi,100y}(\theta) = \frac{651,24 \cdot \theta^{-1,115}}{f_{bd,PIR,100y} \cdot 4,3} \leq 1,0 \quad \text{for a working life of 100 years}$$

$$\theta > 305^\circ \text{C}: \quad k_{b,fi}(\theta) = k_{b,fi,100y}(\theta) = 0,0$$

$f_{bd,fi}$  Design value of the bond strength in case of fire in  $\text{N}\cdot\text{mm}^{-2}$  for a working life of 50 years.

$f_{bd,fi,100y}$  Design value of the bond strength in case of fire in  $\text{N}\cdot\text{mm}^{-2}$  for a working life of 100 years.

$(\theta)$  Temperature in  $^\circ\text{C}$  in the mortar layer.

$k_{b,fi}(\theta)$  Reduction factor under fire exposure for a working life of 50 years.

$k_{b,fi,100y}(\theta)$  Reduction factor under fire exposure for a working life of 100 years.

$f_{bd,PIR}$  Design value of the bond strength in  $\text{N}\cdot\text{mm}^{-2}$  in cold condition according to Table C3 or Table C6 considering the concrete classes, the rebar diameter, the drilling method, and the bond conditions according to EN 1992-1-1: 2004 + A1: 2014 for a working life of 50 years.

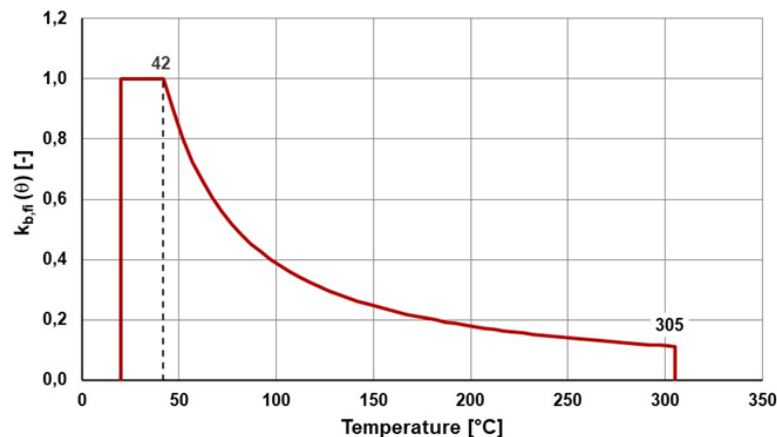
$f_{bd,PIR,100y}$  Design value of the bond strength in  $\text{N}\cdot\text{mm}^{-2}$  in cold condition according to Table C3 or Table C6 considering the concrete classes, the rebar diameter, the drilling method, and the bond conditions according to EN 1992-1-1: 2004 + A1: 2014 for a working life of 100 years.

$\gamma_c$  Partial factor according to EN 1992-1-1: 2004 + A1: 2014.

$\gamma_{M,fi}$  Partial factor according to EN 1992-1-2: 2004 + A1: 2019.

For evidence under fire exposure the anchorage length shall be calculated according to EN 1992-1-1: 2004 + A1: 2014 Equation 8.3 using the temperature-dependent bond strength  $f_{bd,fi}$ .

**Figure C1: Example graph of temperature reduction factor  $k_{b,fi}(\theta)$  for concrete class C20/25 for good bond conditions**



## ANNEX C7

### Performance

#### Essential characteristics under fire exposure

This annex applies to the product described in the main body of the UK Technical Assessment.

#### Essential characteristics under fire exposure

Characteristic and design value of the tensile steel strength of Hilti tension anchor HZA and HZA-R

**Table C9: Characteristic tensile steel strength under direct fire exposure for Hilti tension anchor HZA**

Hilti tension anchor HZA		M12	M16	M20	M24	M27
Characteristic tensile strength	R30	1,7	3,1	4,9	7,1	9,2
	R60	1,3	2,4	3,7	5,3	6,9
	R90	1,1	2,0	3,2	4,6	6,0
	R120	0,8	1,6	2,5	3,5	4,6

**Table C10: Characteristic tensile steel strength under direct fire exposure for Hilti tension anchor HZA-R**

Hilti tension anchor HZA-R		M12	M16	M20	M24
Characteristic tensile strength	R30	2,5	4,7	7,4	10,6
	R60	2,1	3,9	6,1	8,8
	R90	1,7	3,1	4,9	7,1
	R120	1,3	2,5	3,9	5,6

The design value of the tensile steel strength  $N_{Rd,s,fi}$  under direct fire exposure for Hilti tension anchor HZA and HZA-R has to be calculated by the following equation:

$$N_{Rd,s,fi} = \frac{N_{Rk,s,fi}}{\gamma_{M,fi}}$$

$N_{Rk,s,fi}$  Characteristic value of the tensile steel strength under direct fire exposure in kN.

$N_{Rd,s,fi}$  Design value of the tensile steel strength under direct fire exposure in kN.

$\gamma_{M,fi}$  Partial factor according to EN 1992-1-2: 2004 + A1: 2019.





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