

European Technical Assessment

**ETA-16/0142
du 18/04/2016**

English translation prepared by CSTB - Original version in French language

General Part

Nom commercial
Trade name

Injection system Hilti HIT-RE 500 V3 for rebar connection

Famille de produit
Product family

Scellement d'armatures rapportées, diamètres 10 à 40mm, avec
Système d'injection Hilti HIT-RE 500 V3.

**Post installed rebar connections diameter 10 to 40 mm made
with Hilti HIT-RE 500 V3 injection mortar.**

Titulaire
Manufacturer

Hilti Corporation
Feldkircherstrasse 100
FL-9494 Schaan
Principality of Liechtenstein

Usine de fabrication
Manufacturing plants

Hilti plants

Cette évaluation contient:
This Assessment contains

28 pages incluant 25 annexes qui font partie intégrante de
cette évaluation

*28 pages including 25 annexes which form an integral part of
this assessment*

Base de l'ETE
Basis of ETA

DEE 330087-00-0601, Edition juillet 2015
EAD 330087-00-0601, Version July 2015

Cette évaluation remplace:
This Assessment replaces

ETE-16/0142 du 29/03/2016
ETA-16/0142 dated 29/03/2016

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Specific Part

1 Technical description of the product

The Hilti HIT-RE 500 V3 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 and EN 1992-1-2.

Covered are rebar anchoring systems consisting of Hilti HIT-RE 500 V3 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 10 to 40 mm with properties according to Annex C of EN 1992-1-1 and EN 10080. The classes B and C of the rebar are recommended. 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 anchor 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 anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance under static and quasi-static loading	See Annex C1 and C2

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 Annex C3

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 Commission¹, as amended, the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table apply.

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

5 Technical details necessary for the implementation of the AVCP system

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

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

The original French version is signed by

Charles Baloche
Technical Director

¹ Official Journal of the European Communities L 254 of 08.10.1996

Installed condition

Figure A1:

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

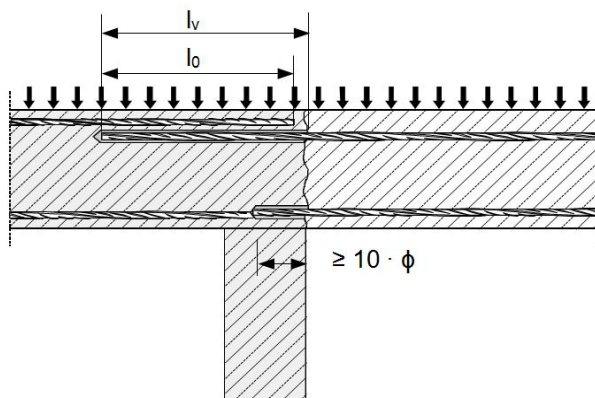


Figure A2:

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

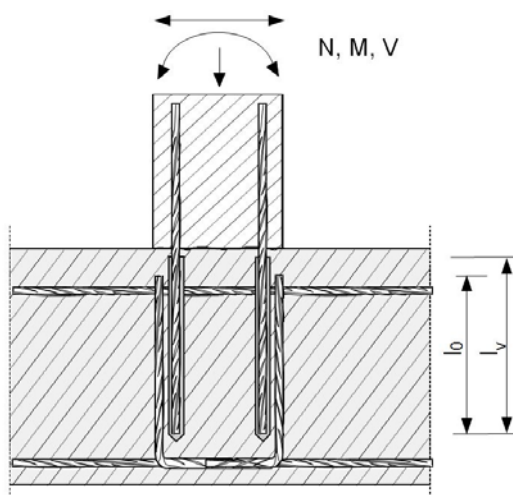
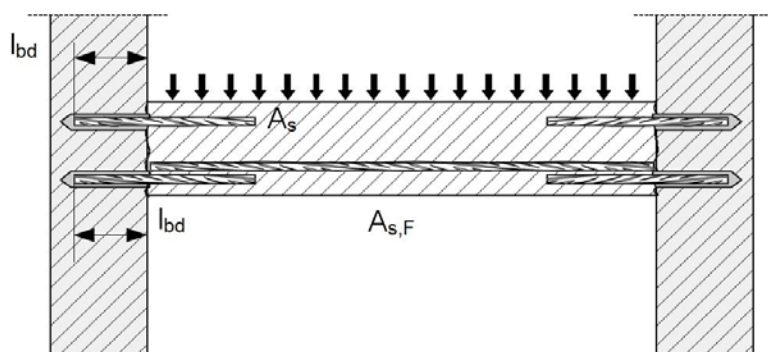


Figure A3:

End anchoring of slabs or beams



Injection system Hilti HIT-RE 500 V3

Product description

Installed condition: application examples of post-installed rebars.

Annex A1

Figure A4:

Rebar connection for components stressed primarily in compression

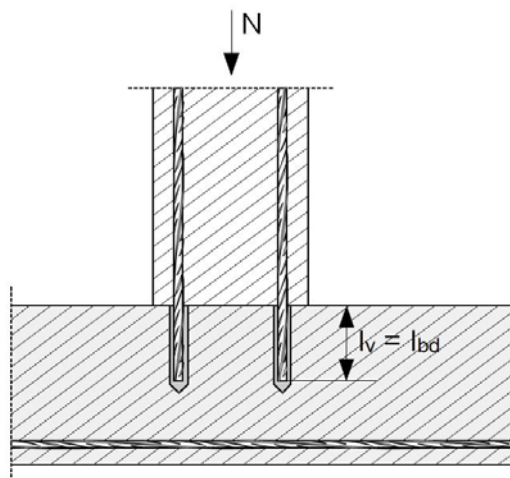
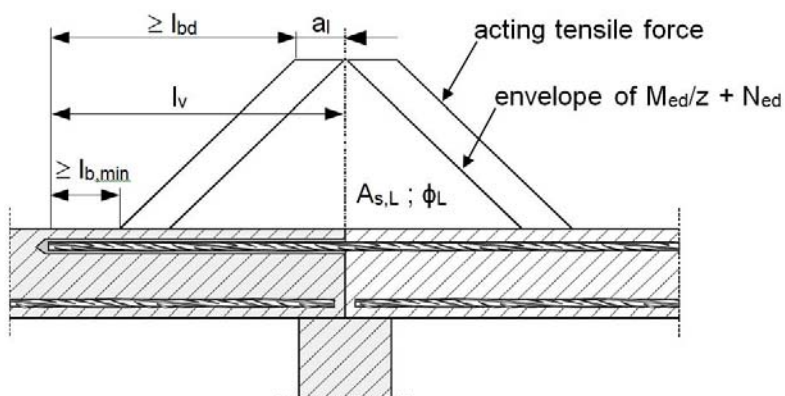


Figure A5:

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 shall be present.
- The shear transfer between existing and new concrete shall be designed according to EN 1992-1-1.
- Preparing of joints according to Annex B2.

Injection system Hilti HIT-RE 500 V3

Product description

Installed condition: application examples of post-installed rebars.

Annex A2

Figure A6:

Overlap joint of a column stressed in bending to a foundation

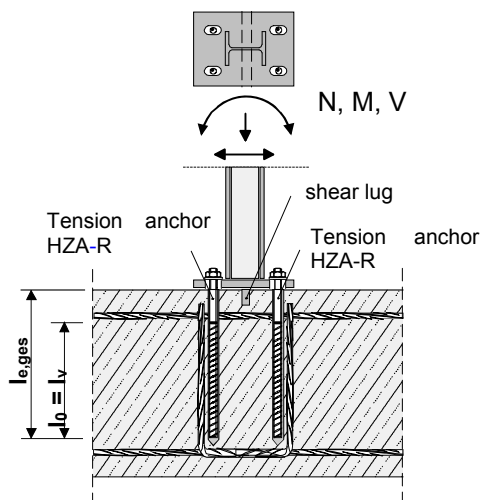


Figure A7:

Overlap joint for the anchorage of barrier posts

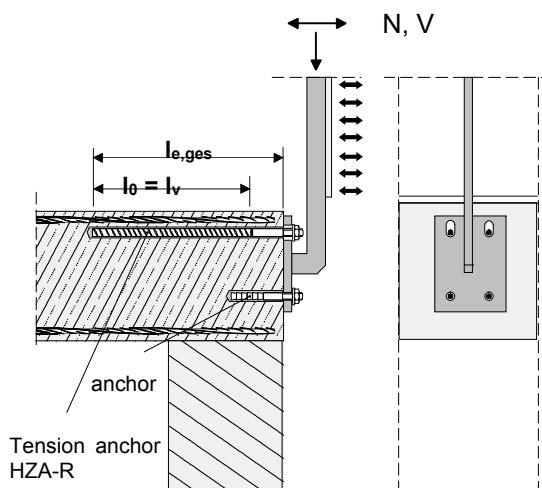
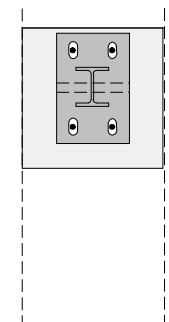
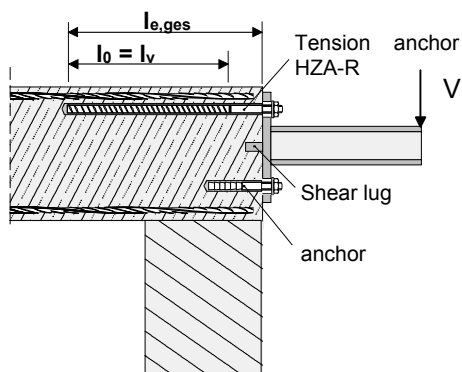


Figure A8:

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 shall be present.

Injection system Hilti HIT-RE 500 V3

Product description

Installed condition: application examples of HZA and HZA-R

Annex A3

Product description: Injection mortar and steel elements

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

330 ml, 500 ml and 1400 ml

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

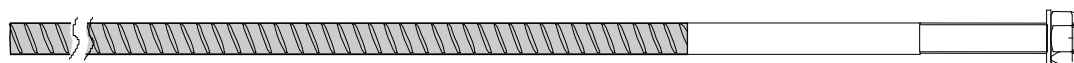


Product name: "Hilti HIT-RE 500 V3"

Static mixer Hilti HIT-RE-M



Steel elements



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



Reinforcing bar (rebar): ϕ 10 to ϕ 40

- Materials and mechanical properties according to Table A1.
- Minimum value of related rib area f_R according to EN 1992-1-1.
- 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:
 $\phi + 2 \cdot 0,07 \cdot \phi = 1,14 \cdot \phi$
(ϕ : Nominal diameter of the bar; h_{rib} : Rib height of the bar)

Injection system Hilti HIT-RE 500 V3

Product description

Injection mortar / Static mixer / Steel elements.
Materials.

Annex A4

Table A1: Materials

Designation	Material
Reinforcing bars (rebars)	
Rebar EN 1992-1-1	Bars and de-coiled rods class B or C with f_{yk} and k according to NDP or NCL of EN 1992-1-1 $f_{uk} = f_{tk} = k \cdot f_{yk}$
Metal parts made of zinc coated steel	
Hilti tension anchor HZA	Round steel with threaded part: electroplated zinc coated $\geq 5 \mu\text{m}$ Rebar: Bars class B according to NDP or NCL of EN 1992-1-1/NA:2013
Washer	Electroplated zinc coated $\geq 5 \mu\text{m}$, hot dip galvanized $\geq 45 \mu\text{m}$
Nut	Strength class of nut adapted to strength class of threaded rod. Electroplated zinc coated $\geq 5 \mu\text{m}$, hot dip galvanized $\geq 45 \mu\text{m}$
Metal parts made of stainless steel	
Hilti tension anchor HZA-R	Round steel with threaded part: Stainless steel 1.4404, 1.4362, 1.4571 EN 10088-1:2014 Rebar: Bars class B according to NDP or NCL of EN 1992-1-1/NA:2013
Washer	Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014
Nut	Strength class of nut adapted to strength class of threaded rod. Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014

Injection system Hilti HIT-RE 500 V3

Product description
Steel elements.
Materials.

Annex A5

Specifications of intended use

Anchorage subject to:

- Static and quasi static loading.
- Fire exposure.

Base material:

- Reinforced or unreinforced normal weight concrete according to EN 206.
- Strength classes C12/15 to C50/60 according to EN 206.
- Maximum chloride content of 0,40 % (CL 0.40) related to the cement content according to EN 206-1.
- Non-carbonated concrete.

Note: In case of a carbonated surface of the existing concrete structure the carbonated layer shall be removed in the area of 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. 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)

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 under static or quasi-static loading in accordance with EN 1992-1-1, Annex B2 and Annex B4
- The actual position of the reinforcement in the existing structure shall be determined on the basis of the construction documentation and taken into account when designing.

Installation:

- Use category: dry or wet concrete (not in flooded holes).
- Drilling technique:
 - hammer drilling (HD),
 - hammer drilling with Hilti hollow drill bit TE-CD, TE-YD (HDB),
 - compressed air drilling (CA)
 - diamond coring, wet (DD),
 - diamond coring, dry (PCC),
 - diamond coring followed by roughening with Hilti roughening tool TE-YRT (RT).
- 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 on the basis of the construction documentation and then marked on the building component for the overlap joint).

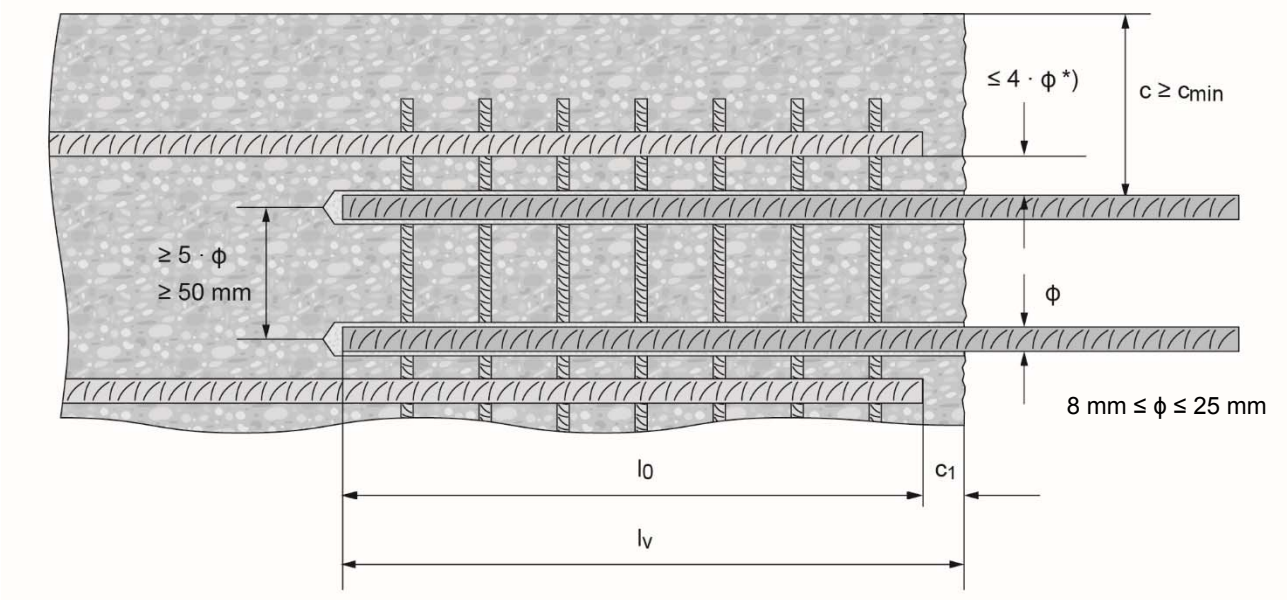
Injection system Hilti HIT-RE 500 V3

Intended Use
Specifications.

Annex B1

Figure B1: General construction rules for post-installed rebars

- 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.
- 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 B1 and to EN 1992-1-1
 ϕ diameter of reinforcement bar
 l_0 lap length, according to EN 1992-1-1
 l_v effective embedment depth $\geq l_0 + c_1$
 d_0 nominal drill bit diameter, see Annex B4

Injection system Hilti HIT-RE 500 V3

Intended Use

General construction rules for post-installed rebars.

Annex B2

Table B2: Hilti tension anchor HZA-R, dimensions

Hilti tension anchor HZA-R			M12	M16	M20	M24
Rebar diameter	ϕ	[mm]	12	16	20	25
Nominal embedment depth and drill hole depth	$l_{e,ges}$	[mm]	170 to 800	180 to 1300	190 to 1300	200 to 1300
Effective embedment depth ($l_v = l_{e,ges} - l_e$)	l_v	[mm]	$l_{e,ges} - 100$			
Length of smooth shaft	l_e	[mm]	100			
Maximum diameter of clearance hole in the fixture ¹⁾	d_f	[mm]	14	18	22	26
Maximum torque moment	T_{max}	[Nm]	40	80	150	200

¹⁾ For larger clearance hole see "TR 029 section 1.1".

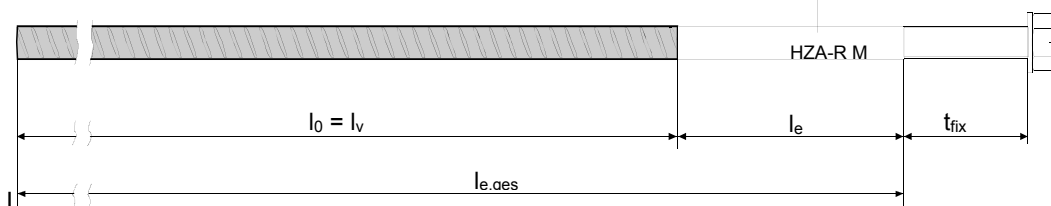
Table B3: Hilti tension anchor HZA, dimensions

Hilti tension anchor HZA			M12	M16	M20	M24	M27
Rebar diameter	ϕ	[mm]	12	16	20	25	28
Nominal embedment depth and drill hole depth	$l_{e,ges}$	[mm]	90 to 800	100 to 1300	110 to 1300	120 to 1300	140 to 1300
Effective embedment depth ($l_v = l_{e,ges} - l_e$)	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 ¹⁾	d_f	[mm]	14	18	22	26	30
Maximum torque moment	T_{max}	[Nm]	40	80	150	200	270

¹⁾ For larger clearance hole see "TR 029 section 1.1".

Hilti Tension Anchor HZA / HZA-R

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



Injection system Hilti HIT-RE 500 V3

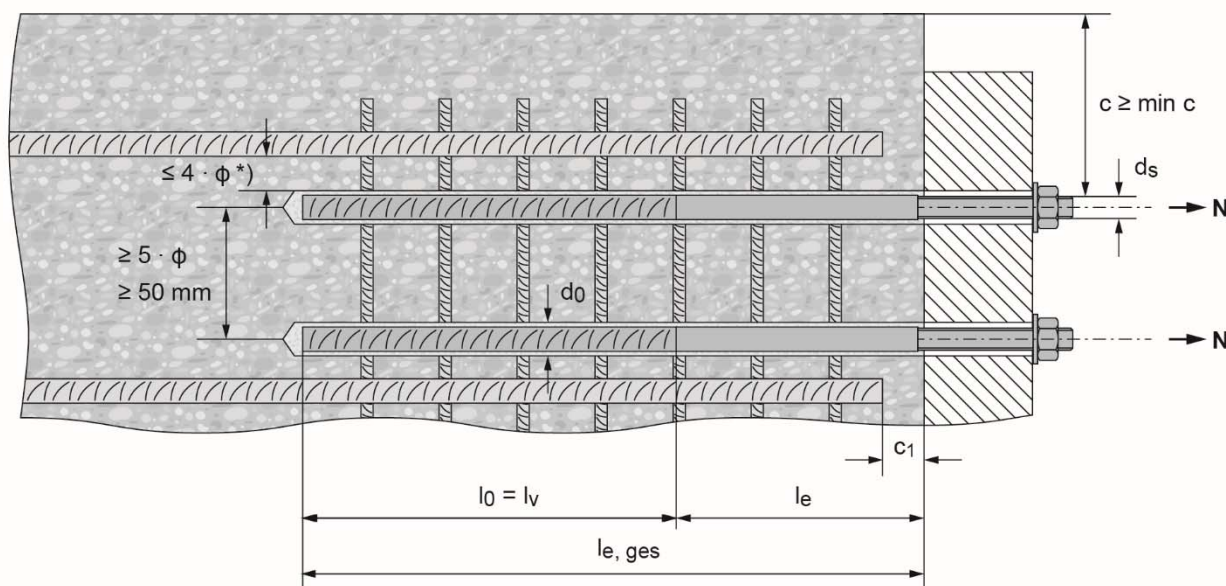
Product description

Installed condition: dimensions for HZA / HZA-R.

Annex B3

Figure B4: 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 European technical assessment (ETA).
- 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 B1 and to EN 1992-1-1

ϕ diameter of reinforcement bar

l_0 lap length, according to EN 1992-1-1

l_v effective embedment depth,

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

$l_{e, ges}$ overall embedment depth

d_0 nominal drill bit diameter

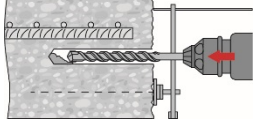
Injection system Hilti HIT-RE 500 V3

Product description.

General construction rules for HZA / HZA-R.

Annex B4

Table B5: Minimum concrete cover $c_{min}^{1)}$ of the post-installed rebar depending on drilling method and drilling tolerance

Drilling method	Bar diameter [mm]	Minimum concrete cover $c_{min}^{1)}$ [mm]		
		Without drilling aid	With drilling aid	
Hammer drilling (HD) and hammer drilling with Hilti hollow drill bit TE-CD, TE-YD (HDB)	$\phi < 25$	$30 + 0,06 \cdot l_v \geq 2 \cdot \phi$	$30 + 0,02 \cdot l_v \geq 2 \cdot \phi$	
	$\phi \geq 25$	$40 + 0,06 \cdot l_v \geq 2 \cdot \phi$	$40 + 0,02 \cdot l_v \geq 2 \cdot \phi$	
Compressed air drilling (CA)	$\phi < 25$	$50 + 0,08 \cdot l_v$	$50 + 0,02 \cdot l_v$	
	$\phi \geq 25$	$60 + 0,08 \cdot l_v \geq 2 \cdot \phi$	$60 + 0,02 \cdot l_v \geq 2 \cdot \phi$	
Diamond coring wet and dry (DD) and (PCC)	$\phi < 25$	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 followed by roughening with Hilti Roughening tool TE-YRT (RT)	$\phi < 25$	$30 + 0,06 \cdot l_v \geq 2 \cdot \phi$	$30 + 0,02 \cdot l_v \geq 2 \cdot \phi$	
	$\phi \geq 25$	$40 + 0,06 \cdot l_v \geq 2 \cdot \phi$	$40 + 0,02 \cdot l_v \geq 2 \cdot \phi$	

¹⁾ See Annex B2, Figure B1.

Comments: The minimum concrete cover acc. EN 1992-1-1.

Injection system Hilti HIT-RE 500 V3

Product description.
Minimum concrete cover c_{min}

Annex B5

Table B6: Maximum embedment depth $l_{v,max}$ depending on bar diameter and dispenser




Elements		Dispensers		
rebar	Hilti Tension anchor	HDM 330, HDM 500	HDE 500	HIT-P8000D
size	size	$l_{v,max}$ [mm]	$l_{v,max}$ [mm]	$l_{v,max}$ [mm]
—	-	1000	-	-
φ 10	-		1000	-
φ 12	HZA(-R) M12		1200	1200
φ 14	-		1400	1400
φ 16	HZA(-R) M16		1600	1600
φ 18	-	700	1800	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	

Injection system Hilti HIT-RE 500 V3

Product description.
Maximum installation length

Annex B6

Table B7: Parameters for use of the Hilti Roughening tool TE-YRT

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

Hilti Roughening tool TE-YRT and wear gauge RTG

TE-YRT	
RTG Delivered with each TE-YRT	

Table B8: Maximum working time and minimum curing time¹⁾

Temperature in the base material T		Maximum working time t_{work}	Initial curing time $t_{\text{cure,ini}}$	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

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

Injection system Hilti HIT-RE 500 V3

Product description.

Dimension: Roughening tool TE-YRT

Maximum working time and minimum curing time.

Annex B7

Table B9: Parameters of drilling, cleaning and setting tools, Hammer drilling and compressed air drilling

Elements	Drill and clean					Installation		
Rebar / Hilti Tension Anchor	Hammer drilling (HD)	Compressed air drilling (CA)	Brush HIT-RB	Air nozzle HIT-DL	Extension for air nozzle	Piston plug HIT-SZ	Extension for piston plug	Maximum embedment depth
								-
size	d ₀ [mm]	d ₀ [mm]	size	size	[-]	size	[-]	l _{v,max} [mm]
-	-	-	-	-	HIT-DL 10/0,8 or HIT-DL V10/1	-	HIT-VL 9/1,0	-
	-	-	-	-		-		-
φ 10	12	-	12	12		12	HIT-VL 11/1,0	250
	14	-	14	14		14		1000
φ 12 / HZA(-R) M12	14	-	14	14		14		250
	16	-	16	16		16		1200
-	-	17	18	16		16		1400
	18	-	18	18		18		
φ 14	-	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	HIT-VL 16/0,7 and/or HIT-VL 16	1600
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	32	32	32	32		32		2400
φ 25 / HZA(-R) M24	32	32	32	32		32		2500
φ 26	35	35	35	32		35		2600
φ 28 / HZA M27	35	35	35	32		35		2800
	-	35	35	32		35		3000
φ 30	37	37	37	32		37		
	40	40	40	32		40		3200
φ 32	-	42	42	32		42		3200
	45	-	45	32		45		
φ 34	45	45	45	32		45		3200
φ 36	55	-	55	32		55		3200
φ 40	-	57	55	32		55		3200

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

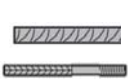







Injection system Hilti HIT-RE 500 V3

Product description.

Setting tools for hammer drilling and compressed air drilling

Annex B8

Table B10: Parameters of drilling, cleaning and setting tools, Hammer drilling with hollow drill bit and Diamond coring, dry

Elements	Drill and clean					Installation		
Rebar / Hilti Tension Anchor	Hammerdrilling with Hollow drill bit (HDB)	Diamond coring, dry (PCC)	Brush HIT-RB	Air nozzle HIT-DL	Extension for air nozzle	Piston plug HIT-SZ	Extension for piston plug	Maximum embedment depth
								-
size	d ₀ [mm]	d ₀ [mm]	size	size	[-]	size	[-]	l _{v,max} [mm]
-	-	-	No cleaning required			-	HIT-VL 9/1,0	-
φ 10	12	-				12		250
	14	-				14		1000
φ 12 / HZA(-R) M12	14	-				14	HIT-VL 11/1,0	250
	16	-				16		1000
φ 14	18	-				18		1000
φ 16 / HZA(-R) M16	20	-				20		1000
φ 18	22	-				22		1000
φ 20 / HZA(-R) M20	25	-				25		1000
φ 22	28	-				28		1000
φ 24	32	-				32		1000
φ 25 / HZA(-R) M24	32	-				32	HIT-VL 16/0,7 and/or HIT-VL 16	1000
φ 26	35	35				32		1000 ²⁾ / 2600
φ 28 / HZA M27	35	35				32		1000 ²⁾ / 2800
φ 30	-	35				32		3000
φ 32	-	47				32		3200
φ 34	-	47				32		3200
φ 36	-	47				32		3200
φ 40	-	52				32		3200

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

²⁾ Maximum embedment depth for use with Hilti Hollow drill bit TE-CD / TE-YD

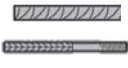

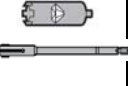





Injection system Hilti HIT-RE 500 V3

Product description.

Setting tools for hollow drilling and diamond drilling

Annex B9

Table B11: Parameters of drilling, cleaning and setting tools, Diamond coring, wet and Diamond coring with roughening

Elements	Drill and clean					Installation		
Rebar / Hilti Tension Anchor	Diamond coring, wet (DD)	Diamond coring with roughening (RT)	Brush HIT-RB	Air nozzle HIT-DL	Extension for air nozzle	Piston plug HIT-SZ	Extension for piston plug	Maximum embedment depth
								-
size	d ₀ [mm]	d ₀ [mm]	size	size	[-]	size	[-]	l _{v,max} [mm]
-	-	-	-	-	HIT-DL 10/0,8 or HIT-DL V10/1	-	HIT-VL 9/1,0	-
-	-	-	-	-		-		-
φ 10	12	-	12	12		12		250
φ 12 / HZA(-R) M12	14	-	14	14		14	HIT-VL 11/1,0	1000
	16	-	16	16		16		250
φ 14	18	18	18	18		18		1200
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		1400 / 900 ²⁾
φ 18	22	22	22	22		22	HIT-VL 16/0,7 and/or HIT-VL 16	1600 / 1000 ²⁾
φ 20 / HZA(-R) M20	25	25	25	25		25		1800 / 1200 ²⁾
φ 22	28	28	28	28		28		2000 / 1300 ²⁾
φ 24	32	32	32	32		32		2200 / 1400 ²⁾
φ 25 / HZA(-R) M24	32	32	32	32		32		2400 / 1600 ²⁾
φ 26	35	35	35	32		35		2500 / 1600 ²⁾
φ 28 / HZA M27	35	35	35	32		35		2600 / 1800 ²⁾
φ 30	37	-	37	32		37		2800 / 1800 ²⁾
φ 32	40	-	40	32		40		3000
φ 34	42	-	42	32		42		3200
	45	-	45	32		45		3200
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 boreholes.

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

Injection system Hilti HIT-RE 500 V3

Product description.

Setting tools for diamond drilling and roughening tool

Annex B10

Cleaning alternatives

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



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



Injection system Hilti HIT-RE 500 V3

Product description.
Parameters of cleaning and setting tools.
Cleaning alternatives.

Annex B11

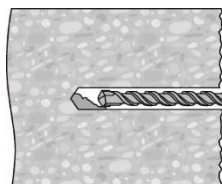
Installation instruction

Hole drilling

Before drilling remove carbonized concrete and clean contact areas (see Annex B1).

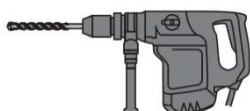
In case of aborted drill hole the drill hole shall be filled with mortar.

a) Hammer drilling

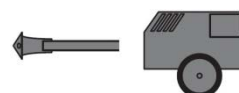


Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode or a compressed air drill using an appropriately sized carbide drill bit.

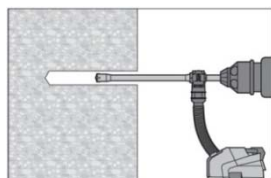
Hammer drill (HD)



Compressed air drill (CA)

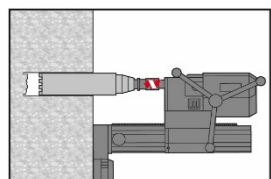


b) Hammer drilling with Hilti hollow drill bit: For dry and wet concrete only.



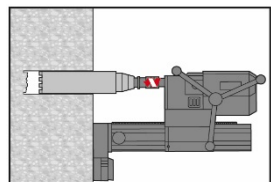
Drill hole to the required embedment depth with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit with Hilti vacuum attachment. This drilling system removes the dust and cleans the drill hole during drilling when used in accordance with the user's manual. After drilling is completed, proceed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

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 followed by roughening with Hilti Roughening tool: For dry and wet concrete only.

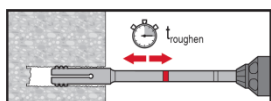


Diamond coring is permissible when suitable diamond core drilling machines and the corresponding core bits are used.

For the use in combination with Hilti roughening tool TE-YRT see parameters in Table B7.

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

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

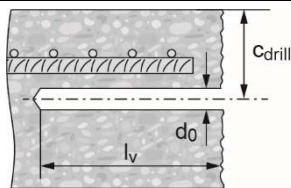


Injection system Hilti HIT-RE 500 V3

Product description.
Installation instruction

Annex B12

Splicing applications



Measure and control concrete cover c .

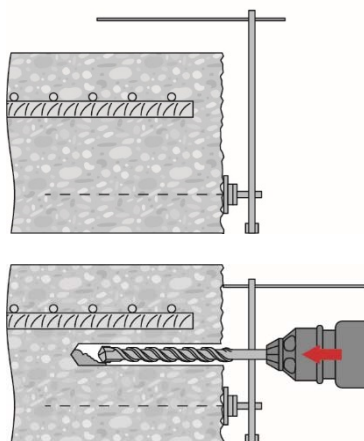
$$C_{\text{drill}} = c + d_0/2.$$

Drill parallel to surface edge and to existing rebar.

Where applicable use Hilti drilling aid HIT-BH.

Drilling aid

For holes $l_v > 20$ cm use drilling aid.



Ensure that the drill hole is parallel to the existing rebar.

Three different options can be considered:

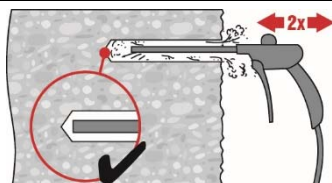
- Hilti drilling aid HIT-BH
- Lath or spirit level
- Visual check

Drill hole cleaning

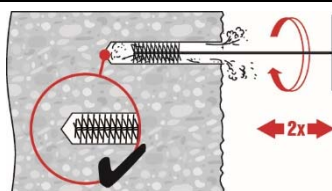
Just before setting the bar the drill hole must be free of dust and debris.
Inadequate hole cleaning = poor load values.

Compressed Air Cleaning (CAC)

For all drill hole diameters d_0 and all drill hole depths $h_0 \leq 20 \cdot d$.

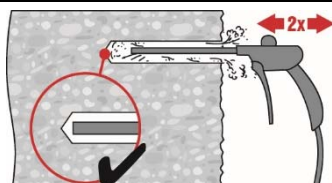


Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust.



Brush 2 times with the specified brush (see 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 $\varnothing \geq$ drill hole \varnothing) - if not the brush is too small and must be replaced with the proper brush diameter.



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

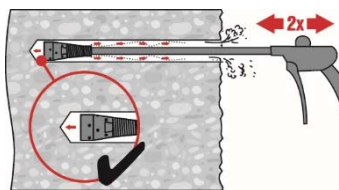
Injection system Hilti HIT-RE 500 V3

Product description.
Installation instruction

Annex B13

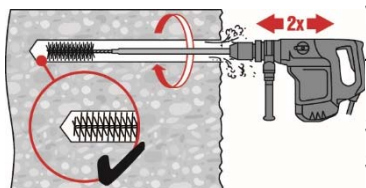
Compressed Air Cleaning (CAC)

For drill holes deeper than 250 mm (for ϕ 8 to ϕ 12) or deeper than $20 \cdot \phi$ (for $\phi > 12$ mm)



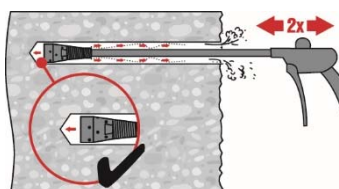
Use the appropriate air nozzle Hilti HIT-DL (see Table B9).
Blow 2 times from the back of the hole over the hole length with oil-free compressed air until return air stream is free of noticeable dust.

Safety tip:
Do not inhale concrete dust.
Use of the dust collector Hilti HIT-DRS is recommended.



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 borehole.

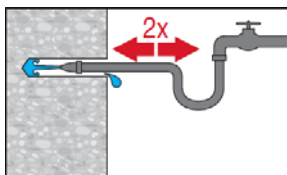


Use the appropriate air nozzle Hilti HIT-DL (see Table B9).
Blow 2 times from the back of the hole over the hole length with oil-free compressed air until return air stream is free of noticeable dust.

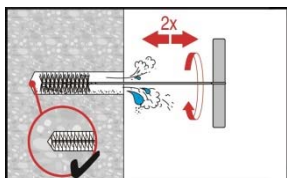
Safety tip:
Do not inhale concrete dust.
Use of the dust collector Hilti HIT-DRS is recommended.

Cleaning of diamond cored holes:

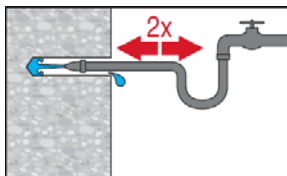
For all drill hole diameters d_0 and all drill hole depths h_0 .



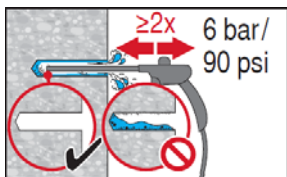
Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.



Brush 2 times with the specified brush (see Table B11) 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 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.

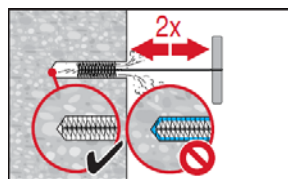


Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust and water.
For drill hole diameters ≥ 32 mm the compressor has to supply a minimum air flow of 140 m³/h.

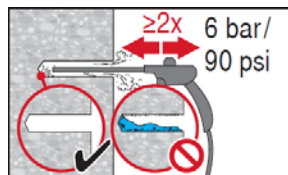
Injection system Hilti HIT-RE 500 V3

Product description.
Installation instruction

Annex B14



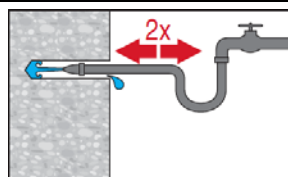
Brush 2 times with the specified brush size (brush $\varnothing \geq$ drill hole \varnothing , see Table B11) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole – if not the brush is too small and must be replaced with the proper brush diameter.



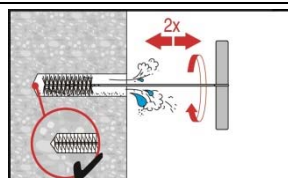
Blow again with compressed air 2 times until return air stream is free of noticeable dust and water.

Cleaning of diamond cored holes followed by roughening:

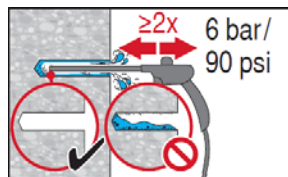
For all drill hole diameters d_0 and all drill hole depths h_0 .



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

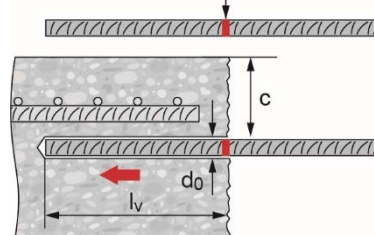


Brush 2 times with the specified brush (see Table B11) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush $\varnothing \geq$ drill hole \varnothing) - if not the brush is too small and must be replaced with the proper brush diameter.



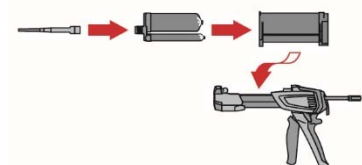
Blow 2 times from the back of the hole (if needed with nozzle extension) over the whole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust and water.
For drill hole diameters ≥ 32 mm the compressor has to supply a minimum air flow of 140 m³/h.

Rebar preparation



Before use, make sure the rebar is dry and free of oil or other residue.
Mark the embedment depth on the rebar (e.g. with tape) $\rightarrow l_v$.
Insert Rebar in borehole to verify hole and setting depth l_v .

Injection preparation

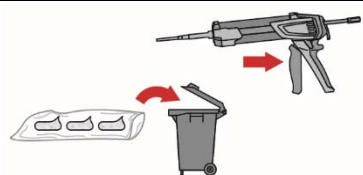


Tightly attach Hilti mixing nozzle HIT-RE-M to foil pack manifold. Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser.
Check foil pack holder for proper function. Insert foil pack into foil pack holder and put holder into dispenser.

Injection system Hilti HIT-RE 500 V3

Product description.
Installation instruction

Annex B15



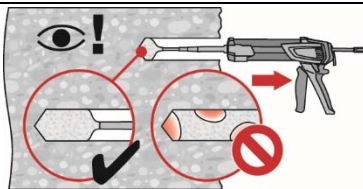
The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded. Discarded quantities are:

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

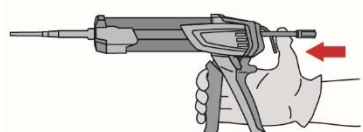
Inject adhesive

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

Injection method for drill hole depth ≤ 250 mm (without overhead applications)

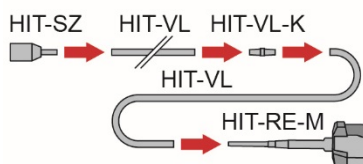


Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull. Fill approximately 2/3 of the drill hole to ensure that the annular gap between the anchor and the concrete is completely filled with adhesive along the embedment length.

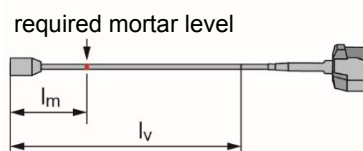


After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

Injection method for drill hole depth > 250 mm or overhead applications



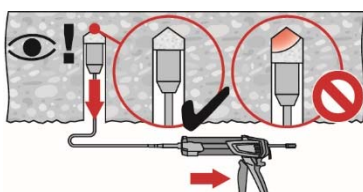
Assemble mixing nozzle HIT-RE-M, extension(s) and piston plug HIT-SZ (see Table B9, B10 or B11). For combinations of several injection extensions use coupler HIT-VL-K. A substitution of the injection extension for a plastic hose or a combination of both is permitted. The combination of HIT-SZ piston plug with HIT-VL 16 pipe and then HIT-VL 16 tube support proper injection.



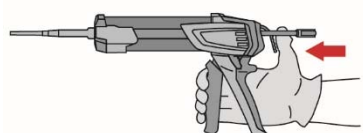
Mark the required mortar level l_m and embedment depth l_v with tape or marker on the injection extension.

estimation:
 $l_m = 1/3 \cdot l_v$

precise formula for optimum mortar volume:
 $l_m = l_v \cdot (1,2 \cdot (\phi^2 / d_0^2) - 0,2)$



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 B9, B10 or B11). 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.

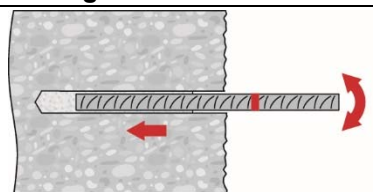
Injection system Hilti HIT-RE 500 V3

Product description.
Installation instruction

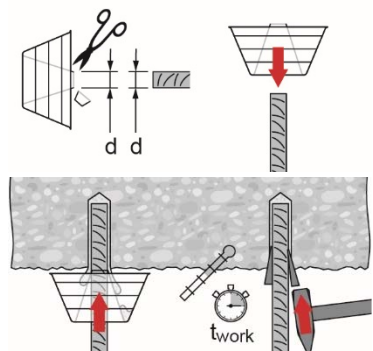
Annex B16

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.

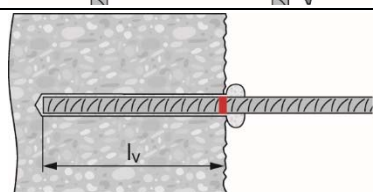


For overhead application:

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

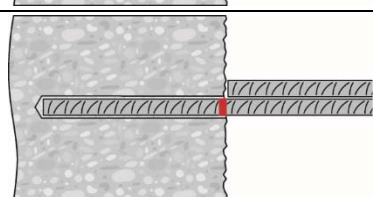
Support the rebar and secure it from falling until mortar has started to harden, e.g. using wedges HIT-OHW.

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

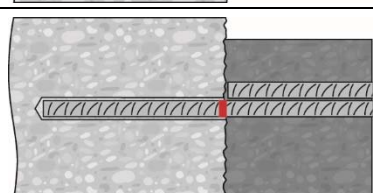


After installing the rebar the annular gap must be completely filled with mortar. Proper installation:

- desired anchoring embedment l_v is reached: embedment mark at concrete surface.
- excess mortar flows out of the borehole after the rebar has been fully inserted until the embedment mark.



Observe the working time t_{work} (see Table B8), 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 B8).

Injection system Hilti HIT-RE 500 V3

Product description.
Installation instruction

Annex B17

Minimum anchorage length and minimum lap length

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{o,min}$ according to EN 1992-1-1 shall be multiplied by the relevant amplification factor α_{lb} given in Table C1.

Table C1: Amplification factor α_{lb} for Hammer drilling, Hammer drilling with Hilti hollow drill bit TE-CD, TE-YD, Compressed air drilling, and Diamond coring followed by roughening with Hilti roughening tool TE-YRT.

Bar diameter	Units	Concrete class								
		C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 10 to ϕ 40	[-]	1,0								

Table C2: Amplification factor α_{lb} for Diamond coring dry and wet

Bar diameter	Units	Concrete class								
		C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 10 to ϕ 12	[-]	1,0								
ϕ 14 to ϕ 36	[-]	Linear interpolation between diameter								
ϕ 40	[-]	1,0	1,0	1,0	1,0	1,2	1,3	1,4	1,4	1,4

Table C3: Bond efficiency value k_b for Hammer drilling, Hammer drilling with Hilti hollow drill bit TE-CD, TE-YD, Compressed air drilling, Diamond coring dry and Diamond coring followed by roughening with Hilti roughening tool TE-YRT

Bar diameter	Units	Concrete class								
		C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 10 to ϕ 40	[-]	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00

Table C4: Design values of the ultimate bond resistance $f_{bd}^{1)}$ in N/mm² for Hammer drilling, Hammer drilling with Hilti hollow drill bit TE-CD, TE-YD, Compressed air drilling, Diamond coring dry and Diamond coring followed by roughening with Hilti roughening tool TE-YRT

Bar diameter	Units	Concrete class								
		C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 10 to ϕ 40	[N/mm ²]	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3

Injection system Hilti HIT-RE 500 V3

Performance.

Minimum anchorage length and minimum lap length.
Design values of ultimate bond resistance f_{bd} . Temperature reduction factor $k_{rt}(\theta)$.

Annex C2

Table C5: Bond efficiency value k_b for Diamond coring wet

Bar diameter	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
φ 10	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,98
φ 12	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,97
φ 14	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,94	0,88
φ 16	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,93	0,87
φ 20	1,00	1,00	1,00	1,00	1,00	1,00	0,99	0,91	0,86
φ 25	1,00	1,00	1,00	1,00	1,00	1,00	0,97	0,89	0,84
φ 28	1,00	1,00	1,00	1,00	1,00	1,00	0,95	0,88	0,82
φ 30	1,00	1,00	1,00	1,00	1,00	1,00	0,94	0,87	0,82
φ 32	1,00	1,00	1,00	1,00	1,00	1,00	0,93	0,86	0,81
φ 36	1,00	1,00	1,00	1,00	1,00	1,00	0,92	0,85	0,79
φ 40	1,00	1,00	1,00	1,00	1,00	0,98	0,90	0,83	0,78

Table C6: Design values of the ultimate bond resistance $f_{bd}^{1)}$ in N/mm² for Diamond coring wet

Bar diameter	Concrete class								
	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
φ 10	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,0
φ 12	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,0
φ 14	1,6	2,0	2,3	2,7	3,0	3,4	3,7	3,7	3,7
φ 16	1,6	2,0	2,3	2,7	3,0	3,4	3,7	3,7	3,7
φ 20	1,6	2,0	2,3	2,7	3,0	3,4	3,4	3,4	3,4
φ 25	1,6	2,0	2,3	2,7	3,0	3,4	3,4	3,4	3,4
φ 28	1,6	2,0	2,3	2,7	3,0	3,4	3,4	3,4	3,4
φ 30	1,6	2,0	2,3	2,7	3,0	3,4	3,4	3,4	3,4
φ 32	1,6	2,0	2,3	2,7	3,0	3,4	3,4	3,4	3,4
φ 36	1,6	2,0	2,3	2,7	3,0	3,4	3,4	3,4	3,4
φ 40	1,6	2,0	2,3	2,7	3,0	3,0	3,0	3,0	3,0

¹⁾ According to EN 1992-1-1 for good bond conditions. For all other bond conditions multiply the values by 0,7.

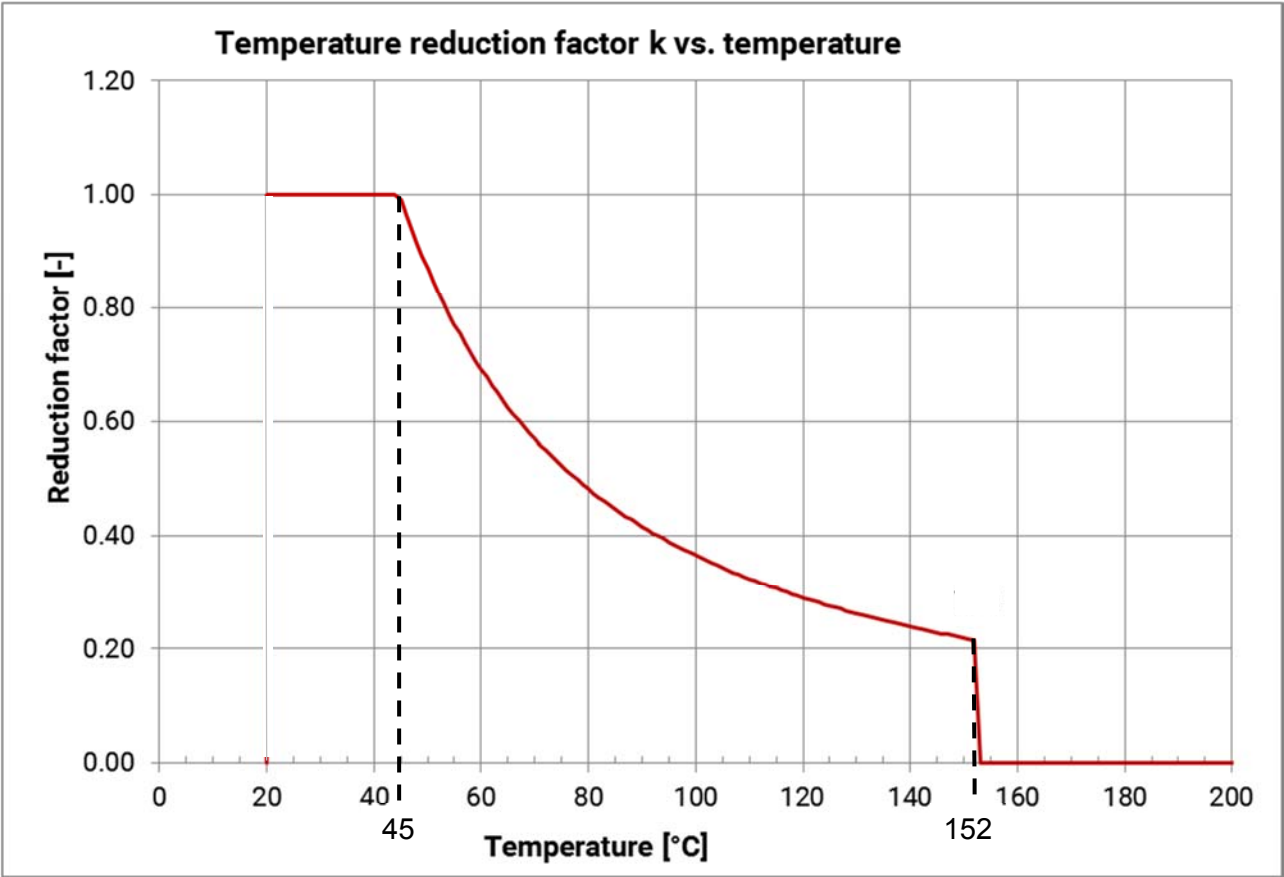
Injection system Hilti HIT-RE 500 V3

Performance.

Minimum anchorage length and minimum lap length.
Design values of ultimate bond resistance f_{bd} . Temperature reduction factor $k_{rt}(\theta)$.

Annex C2

Graph C1 : Temperature reduction factor $k_{fi}(\theta)$



The analytic equation that describe the variation of $k_{fi}(\theta)$ with temperature is given by the following function :

If $45^{\circ}\text{C} \leq \theta \leq 152^{\circ}\text{C}$: $k_{fi}(\theta) = \frac{f_{bm}(\theta)}{f_{bm,rqd,d}} \leq 1.0$

If $\theta < 45^{\circ}\text{C}$: $k_{fi}(\theta) = 1.0$

If $\theta > 152^{\circ}\text{C}$: $k_{fi}(\theta) = 0.0$

With

$$f_{bm}(\theta) = 1178,2 \cdot \theta^{-1,255} \quad \theta \text{ in } ^{\circ}\text{C}$$

Injection system Hilti HIT-RE 500 V3

Performance.
Resistance to fire

Annex C3