Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-12/0083 of 26 June 2018

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Injection System Hilti HIT-HY 200-R for rebar connection
Product family to which the construction product belongs	Post-installed rebar connection under seismic action
Manufacturer	Hilti Aktiengesellschaft 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Corporation
This European Technical Assessment contains	25 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 331522-00-0601
This version replaces	ETA-12/0083 issued on 26 June 2014

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Specific Part

1 Technical description of the product

The subject of this European technical assessment is the post-installed connection, by anchoring or overlap connection joint, of reinforcing bars (rebars) in existing structures made of normal weight concrete, using the injection mortar Hilti HIT-HY 200-R in accordance with the regulations for reinforced concrete construction.

Reinforcing bars are made of steel with a diameter ϕ from 8 to 32 mm according to Annex A. The reinforcing bar is placed into a drilled hole filled with injection mortar and is anchored via the bond between embedded reinforcing bar, injection mortar and concrete.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European assessment Document

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

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the rebar connections of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

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

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

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

In accordance with European Assessment Document EAD No. 331522-00-0601, the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 26 June 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Lange

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Installed condition

Figure A1:

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

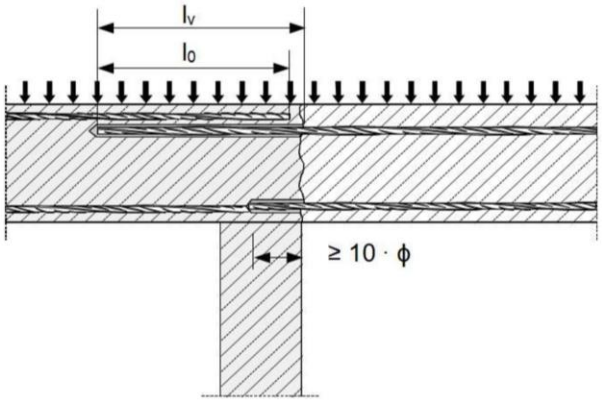


Figure A2:

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

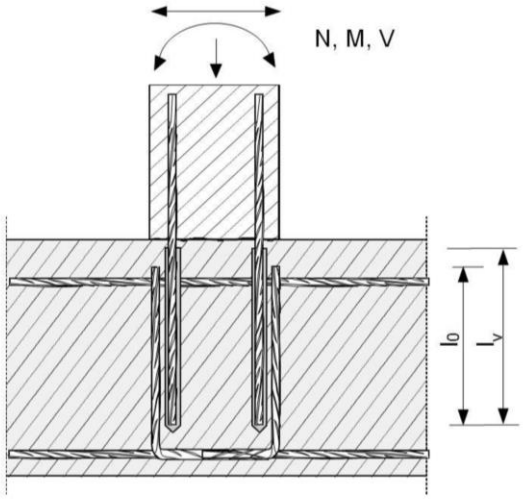
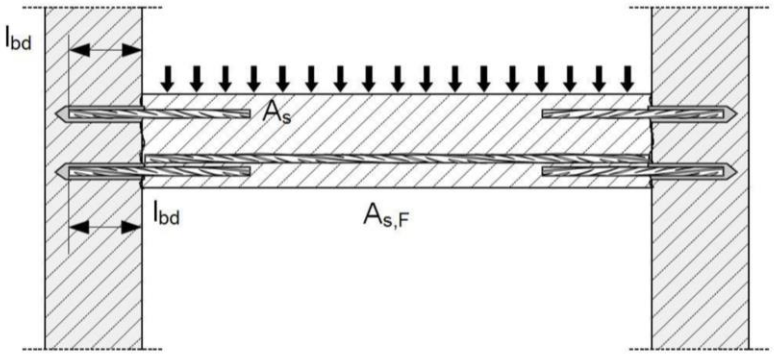


Figure A3:

End anchoring of slabs or beams.



Injection system Hilti HIT-HY 200-R for rebar connections	
Product description Installed condition: application examples of post-installed rebars	**Annex A1**

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Figure A4:

Rebar connection for components stressed primarily in compression.

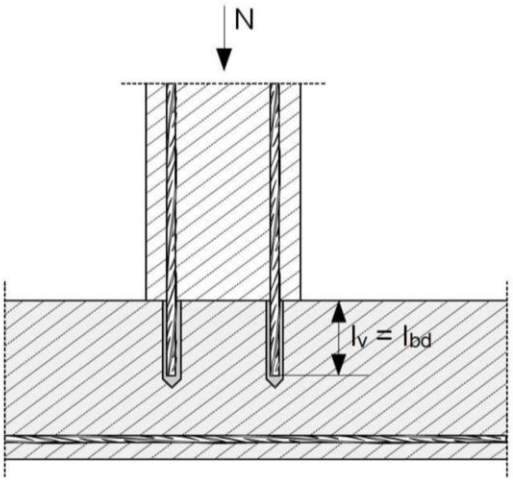
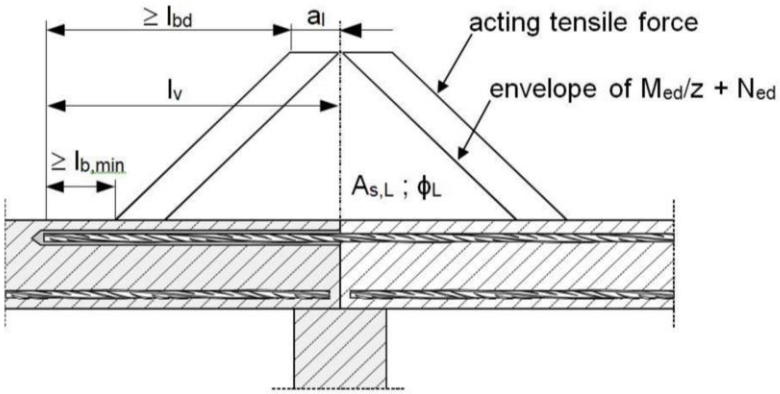


Figure A5:

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 or EN 1998-1:2004 shall be present.
- The shear transfer between existing and new concrete shall be designed according to EN 1992-1-1:2004.
- Preparing of joints according to Annex B2.

Injection system Hilti HIT-HY 200-R for rebar connections	**Annex A2**
Product description Installed condition: application examples of post-installed rebars	

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

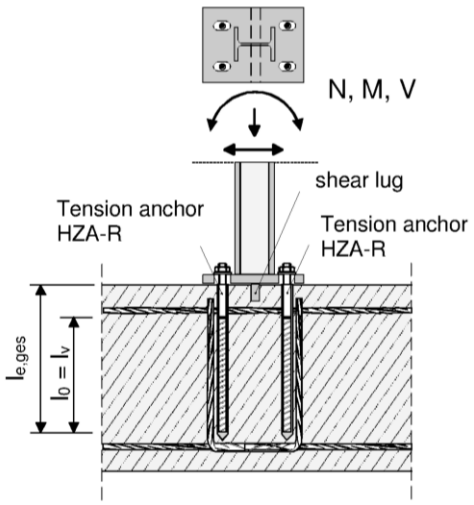


Figure A7:
Overlap joint for the anchorage of barrier posts.

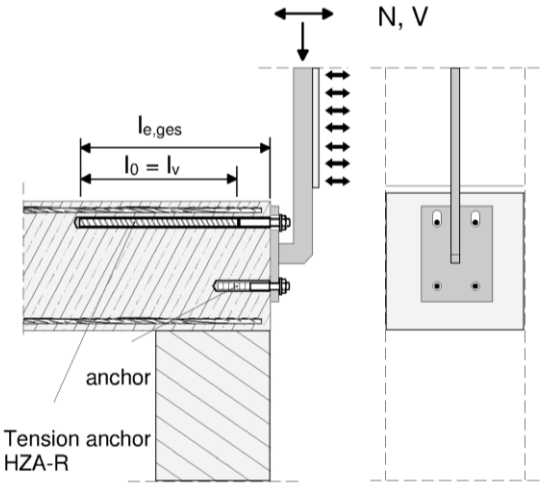
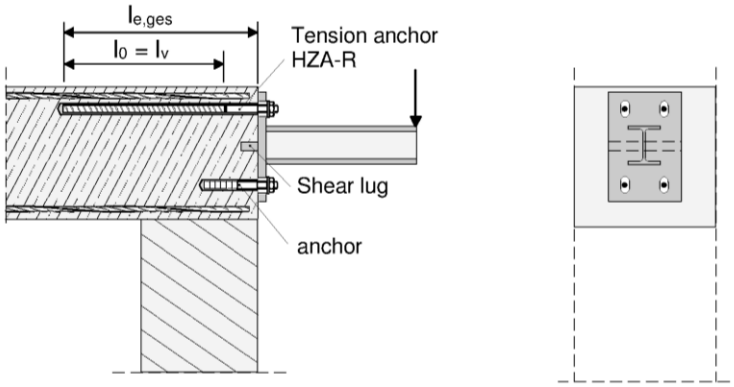


Figure A8:
Overlap joint for the anchorage of cantilever members.



Note to Figure A6 to A8:

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

Injection system Hilti HIT-HY 200-R for rebar connections	**Annex A3**
Product description Installed condition: application examples of HZA and HZA-R	

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Product description: Injection mortar and steel elements

Injection mortar Hilti HIT-HY 200-R: hybrid system with aggregate

330 ml and 500 ml

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

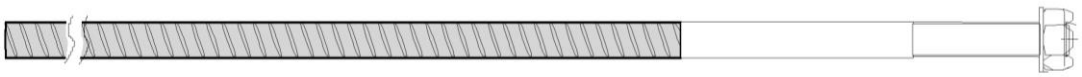
Product name: "Hilti HIT-HY 200-R"

Static mixer Hilti HIT-RE-M

Steel elements

Reinforcing bar (rebar): ϕ 8 to ϕ 32

- Materials and mechanical properties according to Table A1.
- Minimum value of related rib area f_R according to EN 1992-1-1:2004.
- Rib height of the bar h_{rib} shall be in the range:
  $0{,}05 \cdot \phi \le h_{rib} \le 0{,}07 \cdot \phi$
- 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)



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

Injection system Hilti HIT-HY 200-R for rebar connections	**Annex A4**
Product description Injection mortar / Static mixer / Steel elements	

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Table A1: Materials

Designation	Material
Reinforcing bars (rebars)	
Rebar EN 1992-1-1:2004	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 $f_{uk} = f_{tk} = k \cdot f_{yk}$
Metal parts made of zinc coated steel	
Hilti tension anchor HZA	Round steel with threaded part: electroplated zinc coated ≥ 5 µm Rebar: Bars class B according to NDP or NCL of EN 1992-1-1:2004 and National Annexes
Washer	Electroplated zinc coated ≥ 5 µm, hot dip galvanized ≥ 45 µm
Nut	Strength class of nut adapted to strength class of threaded rod. Electroplated zinc coated ≥ 5 µm, hot dip galvanized ≥ 45 µm
Metal parts made of stainless steel	
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 and National Annexes
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

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Specifications of intended use

Anchorages subject to:

- Static and quasi-static loading: rebar size ϕ8 to ϕ32mm, HZA M12 to M27 and HZA-R M12 to M24.
- Seismic loading: rebar size ϕ12 to ϕ32mm.

Base material:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013.
- Strength classes C12/15 to C50/60 according to EN 206:2013.
- Maximum chloride content of 0,40 % (CL 0.40) related to the cement content according to EN 206:2013.
- 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 ϕ + 60 mm prior to the installation of the new rebar. The depth of concrete to be removed shall correspond at least to the minimum concrete cover in accordance with EN 1992-1-1:2004. 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**
  -10 °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 1992-1-1:2004.
- Design under seismic loading in accordance with EN 1998-1:2004.
- 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 hollow drill bit TE-CD, TE-YD (HDB), or compressed air drilling (CA).
- 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-HY 200-R for rebar connections	Annex B1
Intended Use Specifications	

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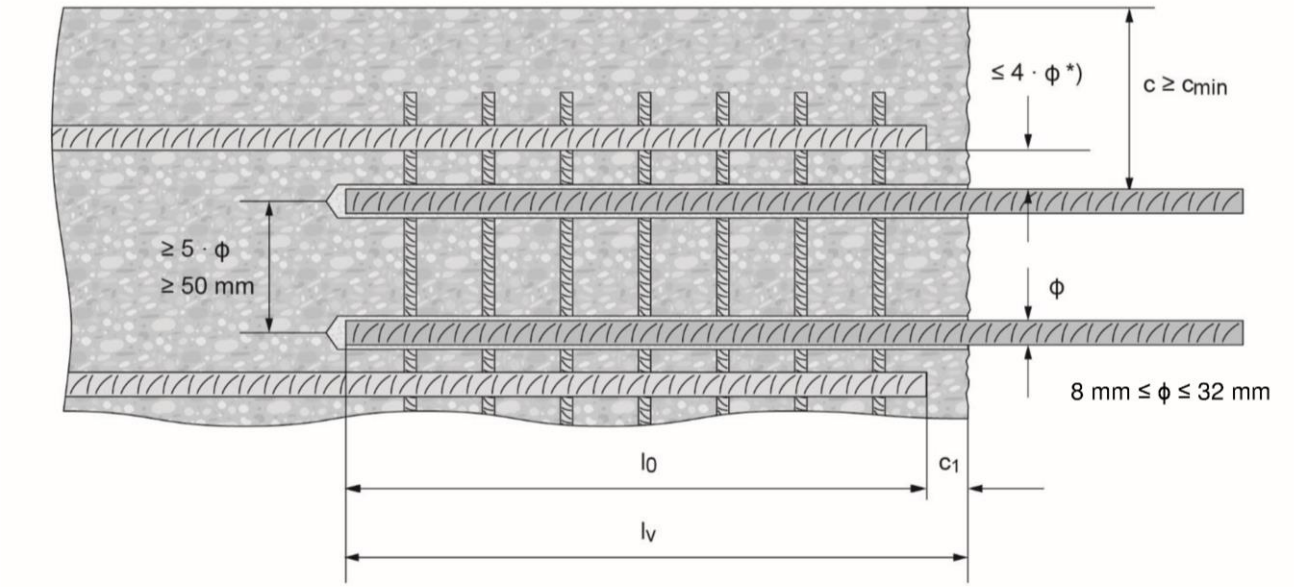
Figure B1: General construction rules for post-installed rebars

- 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 1992-1-1:2004.
- 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 · ϕ, then the lap length shall be increased by the difference between the clear bar distance and 4 · ϕ.

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
ϕ	diameter of reinforcement bar
l_0	lap length according to EN 1992-1-1:2004 for static loading and according to EN 1998-1:2004 for seismic loading.
l_v	effective embedment depth ≥ $l_0 + c_1$
d_0	nominal drill bit diameter

Injection system Hilti HIT-HY 200-R for rebar connections

Intended Use
General construction rules for post-installed rebars

Annex B2

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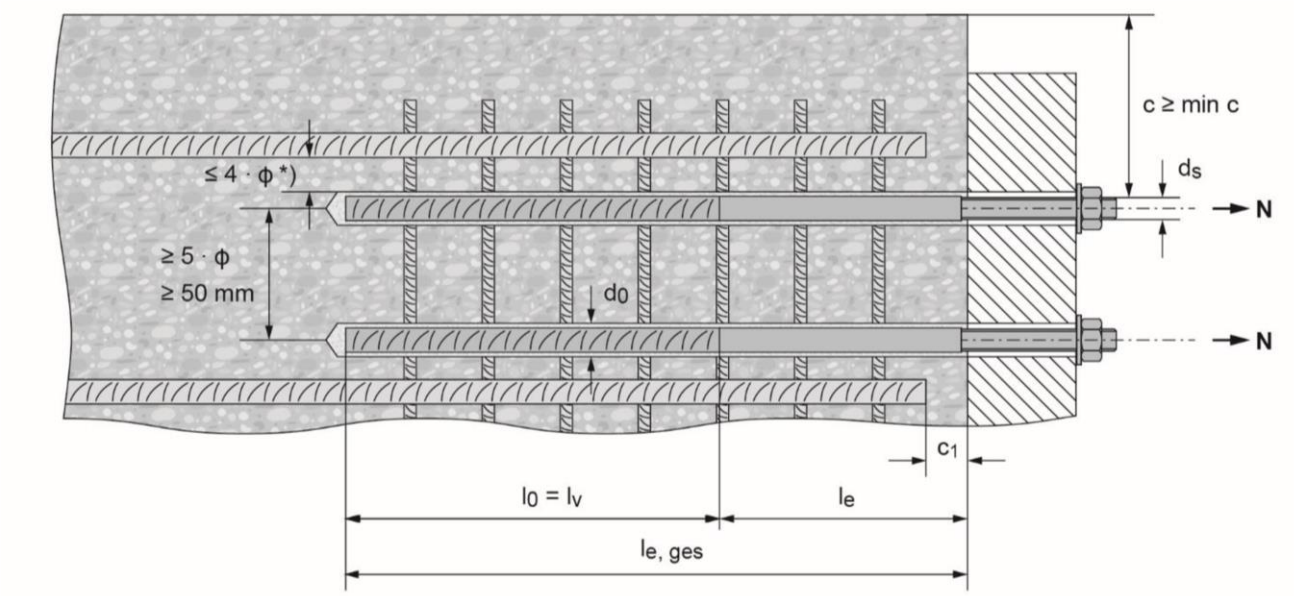
Figure B2: General construction rules for Hilti tension anchor HZA and HZA-R

- 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 · ϕ, then the lap length shall be increased by the difference between the clear bar distance and 4 · ϕ.

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
ϕ	diameter of reinforcement bar
l_0	lap length, according to EN 1992-1-1:2004
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-HY 200-R for rebar connections	**Annex B3**
Intended Use General construction rules for HZA and HZA-R	

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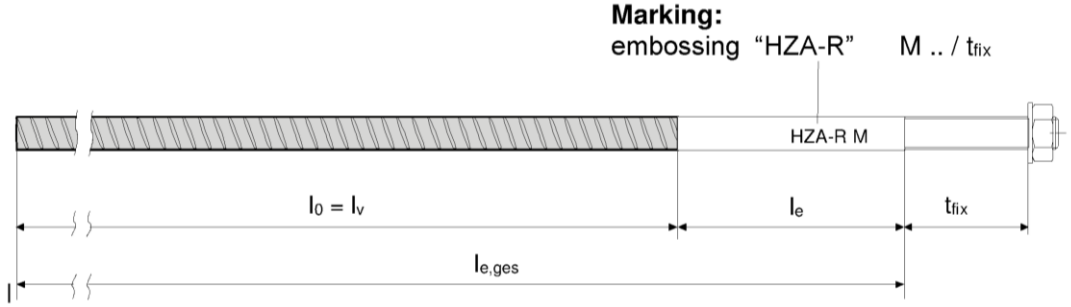
Table B1: Hilti tension anchor HZA dimensions

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	d_f	[mm]	14	18	22	26	30
Maximum torque moment	T_{max}	[Nm]	40	80	150	200	270

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	d_f	[mm]	14	18	22	26
Maximum torque moment	T_{max}	[Nm]	40	80	150	200

Hilti Tension Anchor HZA / HZA-R



Injection system Hilti HIT-HY 200-R for rebar connections

Intended Use
Installation parameters for HZA and HZA-R

Annex B4

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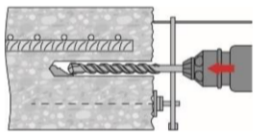
Table B3: Minimum concrete cover c_{min} [1] of post-installed rebar or tension anchor HZA-(R) depending on drilling method and drilling tolerance

Drilling method	Bar diameter [mm]	Minimum concrete cover c_{min} [1] [mm]		
		Without drilling aid	With drilling aid	
Hammer drilling **(HD)** and **(HDB)**[2]	$\phi < 25$	$30 + 0{,}06 \cdot l_v \geq 2 \cdot \phi$	$30 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$	
	$\phi \geq 25$	$40 + 0{,}06 \cdot l_v \geq 2 \cdot \phi$	$40 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$	
Compressed air drilling **(CA)**	$\phi < 25$	$50 + 0{,}08 \cdot l_v$	$50 + 0{,}02 \cdot l_v$	
	$\phi \geq 25$	$60 + 0{,}08 \cdot l_v \geq 2 \cdot \phi$	$60 + 0{,}02 \cdot l_v \geq 2 \cdot \phi$	

[1] See Annexes B2 and B3, Figures B1 and B2.
[2] HDB = hollow drill bit Hilti TE-CD and TE-YD
Comments: The minimum concrete cover acc. EN 1992-1-1:2004 must be observed.
The same minimum concrete covers apply for rebar elements in the case of seismic loading, i.e. $c_{min,seis} = 2\ \phi$.

Table B4: Maximum embedment depth $l_{v,max}$ depending on bar diameter and dispenser

Elements		Dispensers	
Rebar	Hilti Tension Anchor	HDM 330, HDM 500	HDE 500
		Concrete temperature ≥ -10 °C	Concrete temperature ≥ 0 °C
Size	Size	$l_{v,max}$ [mm]	$l_{v,max}$ [mm]
ϕ 8 - 32	HZA M12 to M27 HZA-R M12 to M24	700	1000

Table B5: Maximum working time and minimum curing time

Temperature in the base material T	Maximum working time t_{work}	Minimum curing time t_{cure}
-10 °C to -5 °C	3 hours	20 hours
-4 °C to 0 °C	2 hours	8 hours
1 °C to 5 °C	1 hour	4 hours
6 °C to 10 °C	40 min	2,5 hours
11 °C to 20 °C	15 min	1,5 hours
21 °C to 30 °C	9 min	1 hour
31 °C to 40 °C	6 min	1 hours

Injection system Hilti HIT-HY 200-R for rebar connections	Annex B5
Intended Use Minimum concrete cover / Maximum embedment depth Maximum working time and minimum curing time	

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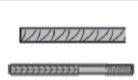
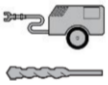
Table B6: Parameters of drilling, cleaning and setting tools for hammer drilling and compressed air drilling

Element	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]
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		250
	14	-	14	14		14	HIT-VL 11/1,0	1000
ϕ 12 / HZA-(R) M12	14	-	14	14		14		250
	16	-	16	16		16		1000
	-	17	18	16		18		
ϕ 14	18	-	18	18		18		1000
	-	17	18	18		18		
ϕ 16 / HZA-(R) M16	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	1000
	-	20	22	20		22		
ϕ 18	22	22	22	22		22		1000
ϕ 20 / HZA-(R) M20	25	-	25	25		25		1000
	-	26	28	25		28		
ϕ 22	28	28	28	28		28		1000
ϕ 24	32	32	32	32		32		1000
ϕ 25 / HZA-(R) M24	32	32	32			32		1000
ϕ 26	35	35	35			35		1000
ϕ 28 / HZA M27	35	35	35			35		1000
ϕ 30	-	35	35			35		1000
	37	-	37			37		
ϕ 32	40	40	40			40		1000

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

Injection system Hilti HIT-HY 200-R for rebar connections

Intended Use
Parameters of drilling, cleaning and setting tools for hammer drilling and compressed air drilling

Annex B6

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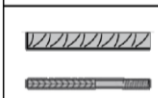
Table B7: Parameters of drilling and setting tools for hammer drilling with hollow drill bit

Element	**Drill** (no cleaning required)				**Installation**		
Rebar / Hilti Tension Anchor	Hammer drilling, hollow drill bit[1] **(HDB)**	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]	Size	Size	[-]	Size	[-]	$l_{v,max}$ [mm]
ϕ 8	12	No cleaning required			12	HIT-VL 9/1,0	200
ϕ 10	12				12		200
	14				14	HIT-VL 11/1.0	240
ϕ 12 / HZA-(R) M12	14				14		240
	16				16		400
ϕ 14	18				18		400
ϕ 16 / M16	20				20	HIT-VL 16/0,7 and/or HIT-VL 16	400
ϕ 18	22				22		400
ϕ 20 / HZA-(R) M20	25				25		400
ϕ 22	28				28		400
ϕ 24	32				32		400
	-				35		2400
ϕ 25 / HZA-(R) M24	32				32		400
	-				35		2500

[1] To be used in combination with Hilti vacuum cleaner with suction volume ≥ 57 l/s.

[2] Assemble extension HIT-VL 16/0,7 with coupler HIT-VL K for deeper drill holes.

Injection system Hilti HIT-HY 200-R for rebar connections	**Annex B7**
Intended Use Parameters of drilling and setting tools for hammer drilling with hollow drill bit	

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Cleaning alternatives

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

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

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

Injection system Hilti HIT-HY 200-R for rebar connections	Annex B8
Intended Use Cleaning alternatives	

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Installation instruction

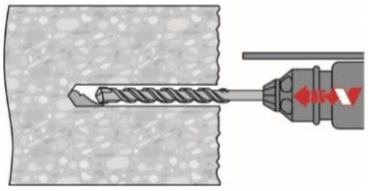
Safety Regulations:

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-HY 200-R.
Important: Observe the installation instruction provided with each foil pack.

Hole drilling

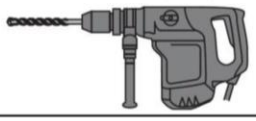
Before drilling remove carbonized concrete and clean contact areas (see Annex B1).
In case of aborted drill hole the drill hole shall be filled with mortar.

a) Hammer drilling

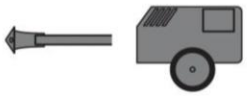


Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode or a compressed air drill using an appropriately sized carbide drill bit.

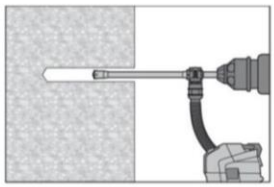
Hammer drill (HD)



Compressed air drill (CA)



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



Drill hole to the required embedment depth with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit attached to Hilti vacuum cleaner VC 20/40 (-Y) (suction volume ≥ 57 l/s) with automatic cleaning of the filter 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.

Injection system Hilti HIT-HY 200-R for rebar connections	Annex B9
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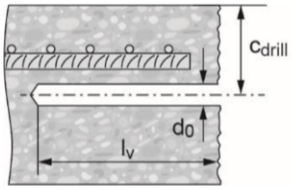
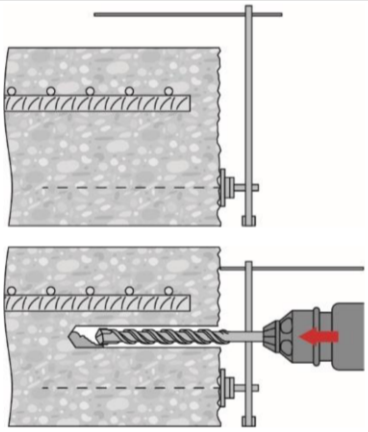
Splicing applications



- Measure and control concrete cover c.
- $c_{drill} = c + d_0/2$.
- Drill parallel to 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:

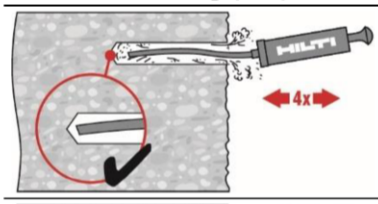
- Hilti drilling aid HIT-BH
- Lath or spirit level
- Visual check

Drill hole cleaning

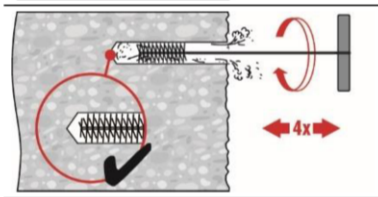
Just before setting the bar the drill hole must be free of dust and debris.
Inadequate hole cleaning = poor load values.

Manual Cleaning (MC)

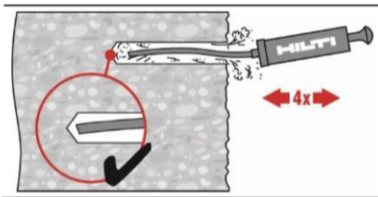
For drill hole diameters $d_0 \leq 20$ mm and drill hole depths $h_0 \leq 10 \cdot \phi$.



The Hilti hand pump may be used for blowing out drill holes up to diameters $d_0 \leq 20$ mm and embedment depths up to $h_{ef} \leq 10 \cdot \phi$.
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 Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.



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

Injection system Hilti HIT-HY 200-R for rebar connections

Intended Use
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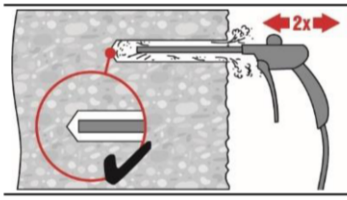
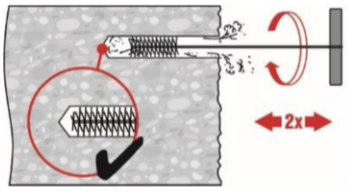
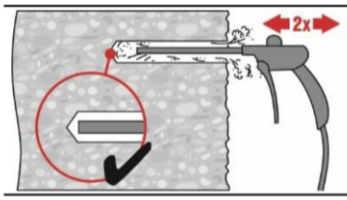
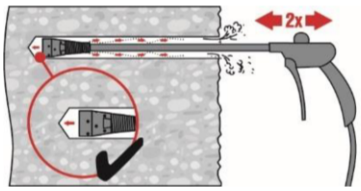
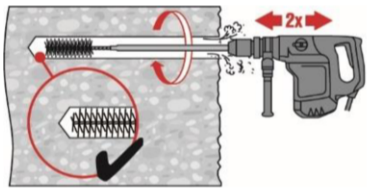
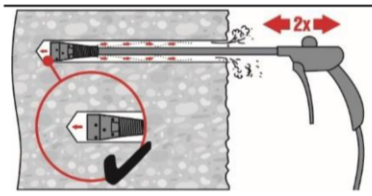
Annex B10

Deutsches Institut für Bautechnik DIBt

Compressed Air Cleaning (CAC)	For all drill hole diameters d_0 and all drill hole depths $h_0 \leq 20 \cdot \phi$.
	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 m³/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 Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.
	Blow again with compressed air 2 times until return air stream is free of noticeable dust.
Compressed Air Cleaning (CAC)	For drill holes deeper than 250 mm (for ϕ 8 to ϕ 12) or deeper than 20 · ϕ (for ϕ > 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. For drill hole diameters ≥ 32 mm the compressor has to supply a minimum air flow of 140 m³/h. 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. 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) and removing it. Safety tip: Start machine brushing operation slowly. Start brushing operation once the brush is inserted in the drillhole.
	Use the appropriate air nozzle Hilti HIT-DL (see Table B4). 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. Use of the dust collector Hilti HIT-DRS is recommended.

Injection system Hilti HIT-HY 200-R for rebar connections

Intended Use
Installation instructions

Annex B11

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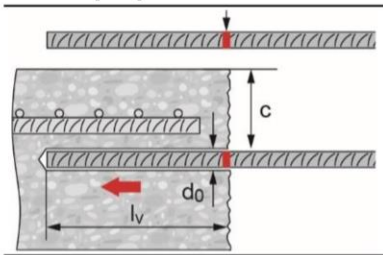
Rebar preparation

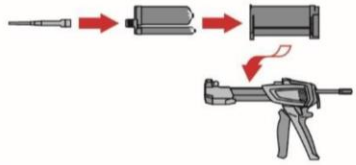


Before use, make sure the rebar is dry and free of oil or other residue.

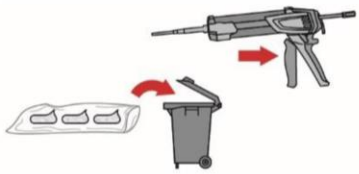
Mark the embedment depth on the rebar (e.g. with tape) → l_v.

Insert Rebar in drillhole 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.



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

2 strokes for 330 ml foil pack,
3 strokes for 500 ml foil pack,
4 strokes for 500 ml foil pack < 5°C.

Injection system Hilti HIT-HY 200-R for rebar connections

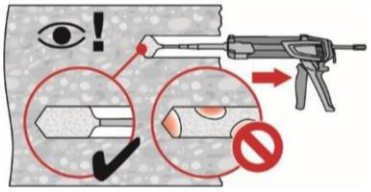
Intended Use
Installation instructions

Annex B12

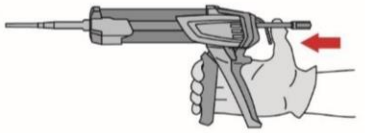
Deutsches Institut für Bautechnik DIBt

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

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

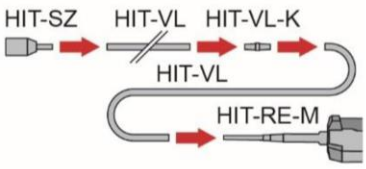


Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull.
Fill approximately 2/3 of the drill hole to ensure that the annular gap between the anchor and the concrete is completely filled with adhesive along the embedment length.

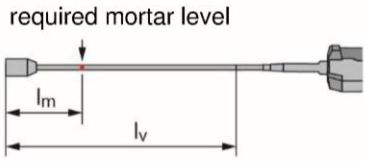


After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

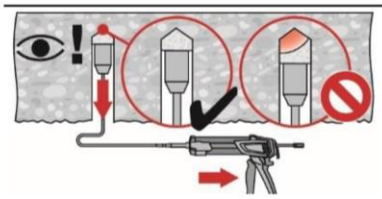
Injection method for drill hole depth > 250 mm or overhead applications



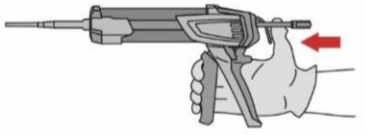
Assemble mixing nozzle HIT-RE-M, extension(s) and piston plug HIT-SZ (see Table B6 and
Table B7).
For combinations of several injection extensions use coupler HIT-VL-K.
A substitution of the injection extension for a plastic hose or a combination of both is permitted.
The combination of HIT-SZ piston plug with HIT-VL 16 pipe and HIT-VL 16 tube supports 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 B6 and
Table B7). Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure.



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-HY 200-R for rebar connections	**Annex B13**
Intended Use Installation instructions	

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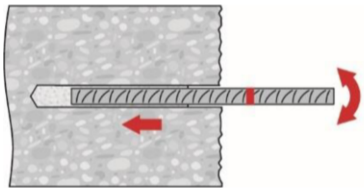
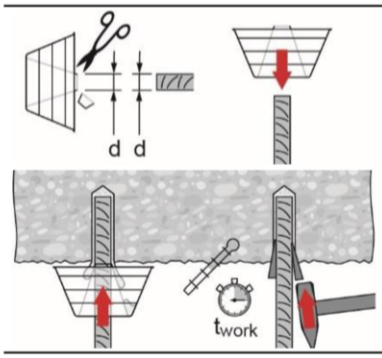
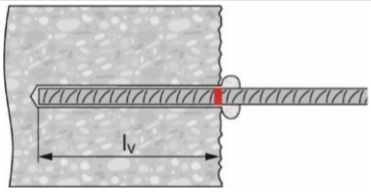
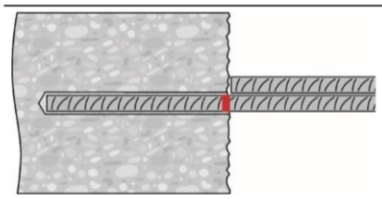
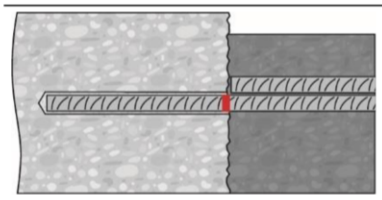
Setting the element	Before use, verify that the element is dry and free of oil and other contaminants.
	For easy installation insert the rebar into the drill hole while slowly twisting until the embedment mark is at the concrete surface level.
	For overhead application: During insertion of the rebar 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. 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 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).

Injection system Hilti HIT-HY 200-R for rebar connections

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Annex B14

Deutsches Institut für Bautechnik DIBt

Minimum anchorage length and minimum lap length under static loading

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{0,min}$ according to EN 1992-1-1:2004 shall be multiplied by the relevant amplification factor α_{lb} given in Table C1.
The design bond strength $f_{bd,PIR}$ is given in Table C3. It is obtained by multiplying the bond strength f_{bd} according to EN 1992-1-1:2004 with the factor k_b according to Table C2.

Table C1: Amplification factor α_{lb} for hammer drilling (HD) and (HDB) and compressed air drilling (CA)

	Reduction factor α_{lb} [-]								
Size	Concrete class								
[mm]	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 8 to ϕ 32 HZA M12 to M27 HZA-R M12 to M24	1,0								

Table C2: Reduction factor k_b for hammer drilling (HD) and (HDB) and compressed air drilling (CA)

	Reduction factor k_b [-]								
Size	Concrete class								
[mm]	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 8 to ϕ 32 HZA M12 to M27 HZA-R M12 to M24	1,0								

Table C3: Design values of the ultimate bond resistance $f_{bd,PIR}$[1)] in N/mm² hammer drilling (HD) and (HDB) and compressed air drilling (CA)

	Bond resistance $f_{bd,PIR}$ [-]								
Size	Concrete class								
[mm]	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 8 to ϕ 32 HZA M12 to M27 HZA-R M12 to M24	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3

[1)] According to EN 1992-1-1:2004 for good bond conditions. For all other bond conditions multiply the values by 0,7.

Injection system Hilti HIT-HY 200-R for rebar connections	**Annex C1**
Performances Amplification factor Design values of ultimate bond resistance $f_{bd,PIR}$ for static loading	

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Minimum anchorage length and minimum lap length under seismic loading

The minimum anchorage length $l_{b,min}$ and the minimum lap length $l_{0,min}$ according to EN 1992-1-1:2004 shall be multiplied by the relevant amplification factor α_{lb} given in Table C1.
The design bond strength $f_{bd,seis}$ is given in Table C5. It is obtained by multiplying the bond strength f_{bd} according to EN 1992-1-1:2004 with the factor $k_{b,seis}$ according to Table C4.
The minimum concrete cover according to Table B1 and $c_{min,seis} = 2\phi$ applies.

Table C4: Seismic reduction factor $k_{b,seis}$ for hammer drilling (HD) and (HDB) and compressed air drilling (CA)

	Reduction factor $k_{b,seis}$ [-]							
Size	Concrete class							
[mm]	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 12 to ϕ 18	1,0				0,90	0,82	0,76	0,71
ϕ 20 to ϕ 30	1,0						0,92	0,86
ϕ 32	1,0							

Table C5: Design values of the ultimate bond resistance $f_{bd,seis}$[1)] in N/mm² for seismic loading for hammer drilling (HD) and (HDB) and compressed air drilling (CA)

	Bond resistance $f_{bd,seis}$ [-]							
Size	Concrete class							
[mm]	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
ϕ 12 to ϕ 18	2,0	2,3	2,7	3,0	3,0	3,0	3,0	3,0
ϕ 20 to ϕ 30	2,0	2,3	2,7	3,0	3,4	3,7	3,7	3,7
ϕ 32	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3

[1)] According to EN 1992-1-1:2004 for good bond conditions. For all other bond conditions multiply the values by 0,7.