Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

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

European Technical Assessment ETA-18/0972 of 26 September 2024

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-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D
Product family to which the construction product belongs	Bonded fasteners and bonded expansion fasteners for use in concrete
Manufacturer	Hilti Aktiengesellschaft Feldkircherstrasse 100 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Plants
This European Technical Assessment contains	21 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 330499-02-0601, Edition 12/2023
This version replaces	ETA-18/0972 issued on 30 November 2023

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Specific Part

1 Technical description of the product

The Injection systems Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D are bonded fasteners consisting of a cartridge with injection mortar Hilti HIT-HY 200-A or Hilti HIT-HY 200-R or Hilti HIT-HY 200-A V3 or Hilti HIT-HY 200-R V3 and the steel element Hilti HAS-D with Hilti sealing washer, a calotte nut and a lock nut in the range of M12, M16 and M20.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between steel element, injection mortar and concrete.

The 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 anchor 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 to static and quasi-static tension load	See Annex B2, C1 and C2
Characteristic resistance to static and quasi-static shear load	See Annex C3
Displacements for static and quasi-static load	See Annex C4
Characteristic resistance for seismic category C1 and C2	No performance assessed

3.2 Safty in Case of fire (BWR 2)

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

3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed

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

In accordance with the European Assessment Document EAD 330499-02-0601 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 at Deutsches Institut für Bautechnik.

The following standards and documents are referred to in this European Technical Assessment:

- EN ISO 683-4:2018	Heat-treatable steels, alloy steels and free-cutting steels - Part 4: Free-cutting steels (ISO 683-4:2016)
- EN 206:2013 + A2:2021	Concrete - Specification, performance, production and conformity
- EN 14889-1:2006	Fibres for concrete - Part 1: Steel fibres - Definitions, specifications and conformity
- EN 1992-4:2018	Eurocode 2: Design of concrete structures - Part 4: Design of fastenings for use in concrete
- EOTA TR 055	Design of fastenings based on EAD 330232-00-0601, EAD 330499-00-0601 and EAD 330747-00-0601, February 2018

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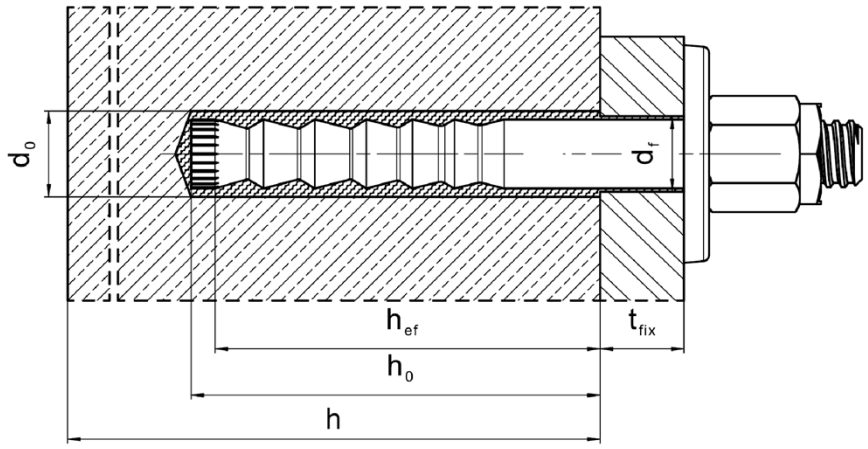
Beatrix Wittstock
Head of Section

beglaubigt:
Stiller

Deutsches Institut für Bautechnik

DIBt

Installed condition



Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	
Product description Installed condition	**Annex A1**

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Product description: Injection mortar

Injection mortar Hilti HIT-HY 200-A, Hilti HIT-HY 200-R, Hilti HIT-HY 200-A V3 and Hilti HIT-HY 200-R V3: hybrid system with aggregate, foil pack 330 ml and 500 ml

Marking:
HILTI HIT
HY 200-A
Production time and production line
Expiry date mm/yyyy

Product name: “Hilti HIT-HY 200-A”

Marking:
HILTI HIT
HY 200-R
Production time and production line
Expiry date mm/yyyy

Product name: “Hilti HIT-HY 200-R”

Marking:
HILTI HIT
HY 200-A V3
Production time and production line
Expiry date mm/yyyy

Product name: “Hilti HIT-HY 200-A V3”

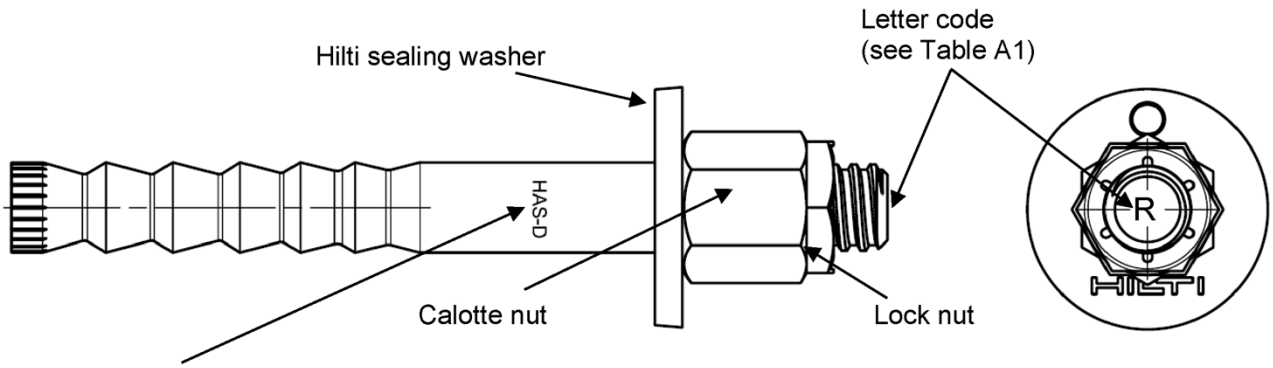
Marking:
HILTI HIT
HY 200-R V3
Production time and production line
Expiry date mm/yyyy

Product name: “Hilti HIT-HY 200-R V3”

Static mixer Hilti HIT-RE-M

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	**Annex A2**
Product description Injection mortar / Static mixer	

Fastener: Hilti HAS-D: M12, M16 and M20 with sealing washer



Marking:
HAS-D M..x L Fastener type as well as size and length of anchor rod

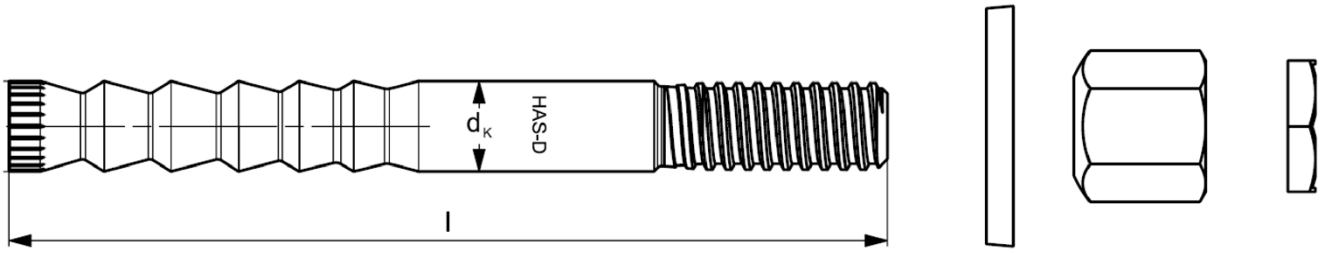


Table A1: Letter code for identification of anchor rod length[1)]

Letter code			I	**J**	K	**L**	**M**	N	**O**	P	Q	**R**
Length of anchor rod l	≥	[mm]	139,7	**152,4**	165,1	**177,8**	**190,5**	203,2	**215,9**	228,6	241,3	**254,0**
	<	[mm]	152,4	**165,1**	177,8	**190,5**	**203,2**	215,9	**228,6**	241,3	254,0	**279,4**

Letter code			S	T	U	V	W	X	Y	Z	>Z
Length of anchor rod l	≥	[mm]	279,4	304,8	330,2	355,6	381,0	406,4	431,8	457,2	482,6
	<	[mm]	304,8	330,2	355,6	381,0	406,4	431,8	457,2	482,6	

1) Anchor length in bold is standard item. For selection of other anchor lengths, check availability of the items.

Table A2: Dimensions

HAS-D…			**M12**	**M16**	**M20**
Shaft diameter	d_k	[mm]	12,5	16,5	22,0
Length of anchor rod l	≥	[mm]	143	180	242
	≤	[mm]	531	565	623
Calotte nut	SW	[mm]	18/19	24	30
Lock nut	SW	[mm]	19	24	30

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D

Product description
Steel element

Annex A3

Hilti sealing washer to fill the annular gap between anchor and fixture

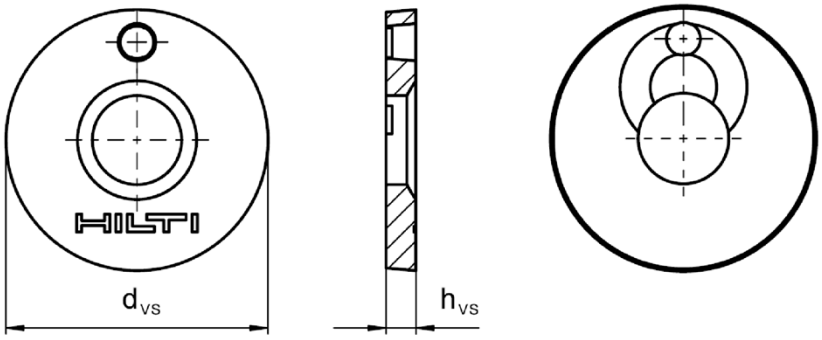


Table A3: Geometry of Hilti sealing washer

Size			M12	M16	M20
Diameter of sealing washer	d_{vs}	[mm]	44	52	60
Thickness of sealing washer	h_{vs}	[mm]	5	6	

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	Annex A4
Product description Steel element	

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Table A4: Materials

Designation	Material
Anchor rod HAS-D	Steel acc. to EN ISO 683-4, galvanized and coated
Sealing washer	Steel, electroplated zinc coated ≥ 5 µm
Calotte nut	Steel, electroplated zinc coated ≥ 5 µm
Lock nut	Steel, electroplated zinc coated ≥ 5 µm

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Specifications of intended use

Anchorages subject to:

- Static and quasi-static loading.

Base material:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206.
- Strength classes C20/25 to C50/60 according to EN 206.
- Cracked and uncracked concrete.
- The fastener is intended to be used in fibre reinforced concrete according to EN 206:2013 + A2:2021 including steel fibres according to EN 14889-1:2006 clause 5, group I. The maximum content of steel fibres is 80 kg/m³.

Temperature in the base material:

- **at installation**
  -10 °C to +40 °C for the standard variation of temperature after installation
- **in-service**
  Temperature range: -40 °C to +80 °C
  (max. long term temperature +50 °C and max. short term temperature +80 °C)

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions.

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e. g. position of the fastener relative to reinforcement or to supports, etc.).
- Anchorages under static or quasi-static loading are designed in accordance with:
  EN 1992-4 and EOTA Technical Report TR 055.
- The design method according to EN 1992-4:2018 applies for use in SFRC with the essential characteristics as specified for plain concrete without fibres.

Installation:

- Concrete condition I1: dry or wet concrete (not in flooded holes) for all drilling techniques.
- Drilling techniques:
  - hammer drilling,
  - hammer drilling with hollow drill bit TE-CD, TE-YD,
  - diamond coring.
- Installation direction D3: downward, horizontal and upward (e.g. overhead) installation.
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	**Annex B1**
Intended Use Specifications	

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Table B1: Installation parameters

HAS-D…				M12	M16	M20
Diameter of fastener		d	[mm]	12	16	20
Nominal diameter of drill bit		d_0	[mm]	14	18	24
Effective embedment depth		h_{ef}	[mm]	100	125	170
Minimum drill hole depth		h_0	[mm]	105	133	180
Minimum thickness of concrete member		h_{min}	[mm]	130	160[1] / 170	220[1] / 230
Pre-setting: Maximum diameter of clearance hole in the fixture		d_f	[mm]	14	18	24
Through-setting: Maximum diameter of clearance hole in the fixture		d_f	[mm]	16	20	26
Installation torque moment		T_{inst}	[Nm]	30	50	80
Uncracked concrete	Minimum spacing	$s_{min,ucr}$	[mm]	80[2]	60	80
	Minimum edge distance	$c_{min,ucr}$	[mm]	55[2]	60	80
Cracked concrete	Minimum spacing	$s_{min,cr}$	[mm]	50	60	80
	Minimum edge distance	$c_{min,cr}$	[mm]	50	60	80

[1] The reverse side of the concrete member shall have no break-through after drilling.

[2] For min. edge distance $c_{min} \geq 80$ mm, min. spacing $s_{min} = 55$ mm

Table B2: Methods for application of torque

HAS-D…			M12	M16	M20
Torque wrench			✓	✓	✓
Machine torqueing with Hilti SIW impact wrench and SI-AT adaptive torque module [1]		SIW4 AT	✓	-	-
		SIW6 AT	✓	✓	✓

[1] Equivalent combination of Hilti SIW + SI-AT tool, compatible to this anchor type, may be used.

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	Annex B2
Intended use Installation parameters	

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Table B3: Maximum working time and minimum curing time HIT-HY 200-A and HIT-HY 200-R

Temperature in the base material T [1]	HIT-HY 200-A		HIT-HY 200-R	
	Maximum working time t_{work}	Minimum curing time t_{cure}	Maximum working time t_{work}	Minimum curing time t_{cure}
-10 °C to -5 °C	1,5 hours	7 hours	3 hours	20 hours
> -5 °C to 0 °C	50 min	4 hours	2 hours	8 hours
> 0 °C to 5 °C	25 min	2 hours	1 hour	4 hours
>5 °C to 10 °C	15 min	75 min	40 min	2,5 hours
>10 °C to 20 °C	7 min	45 min	15 min	1,5 hours
>20 °C to 30 °C	4 min	30 min	9 min	1 hour
>30 °C to 40 °C	3 min	30 min	6 min	1 hour

[1] The minimum temperature of the foil pack is 0°C.

Table B4: Maximum working time and minimum curing time HIT-HY 200-A V3 and HIT-HY 200-R V3

Temperature in the base material T [1]	HIT-HY 200-A V3		HIT-HY 200-R V3	
	Maximum working time t_{work}	Minimum curing time t_{cure}	Maximum working time t_{work}	Minimum curing time t_{cure}
-10 °C to -5 °C	1,5 hours	7 hours	3 hours	20 hours
> -5 °C to 0 °C	50 min	4 hours	1,5 hours	8 hours
> 0 °C to 5 °C	25 min	2 hours	45 min	4 hours
>5 °C to 10 °C	15 min	75 min	30 min	2,5 hours
>10 °C to 20 °C	7 min	45 min	15 min	1,5 hours
>20 °C to 30 °C	4 min	30 min	9 min	1 hour
>30 °C to 40 °C	3 min	30 min	6 min	1 hour

[1] The minimum temperature of the foil pack is 0°C.

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	Annex B3
Intended use Maximum working time and minimum curing time	

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Table B5: Parameters of drilling, cleaning and setting tools

Fastener	Drill and clean				Installation
HAS-D	Hammer drilling		Diamond coring	Brush	Piston plug
		Hollow drill bit TE-CD, TE-YD[1)]			
					
Size	d_0 [mm]	d_0 [mm]	d_0 [mm]	HIT-RB	HIT-SZ
M12	14	14	14	14	14
M16	18	18	18	18	18
M20	24	24	24	24	24

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

Table B6: 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.

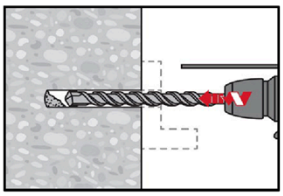
Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	**Annex B4**
Intended use Drilling, cleaning and setting tools	

Deutsches Institut für Bautechnik DIBt

Installation instruction

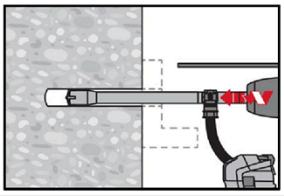
Hole drilling

a) Hammer drilling



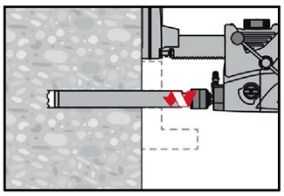
Through-setting: Drill hole through the clearance hole in the fixture to the required drilling depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.
Pre-setting: Drill hole to the required drilling depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

b) Hammer drilling with Hilti hollow drill bit (AC)



Pre- / Through-setting: Drill hole to the required embedment depth with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit with vacuum attachment following the requirements given in Table B5. This drilling system removes the dust and cleans the drill hole during drilling when used in accordance with the user's manual. After drilling is completed, proceed to the "injection preparation" step in the installation instruction.

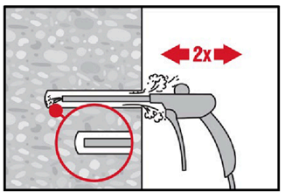
c) Diamond coring



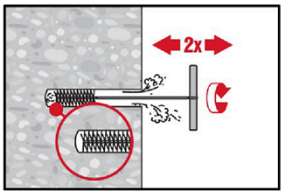
Diamond coring is permissible when suitable diamond core drilling machines and corresponding core bits are used.
Through-setting: Drill hole through the clearance hole in the fixture to the required drilling depth.
Pre-setting: Drill hole to the required embedment depth.

Drill hole cleaning: just before setting the fastener, the drill hole must be free of dust and debris.

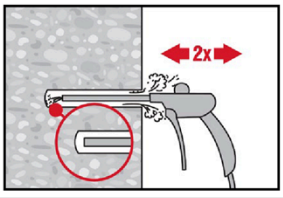
a) Compressed Air Cleaning (CAC): for all drill hole diameters d_0 and all drill hole depths h_0.



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



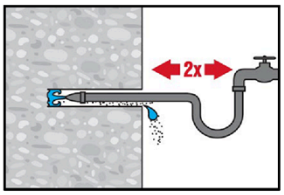
Brush 2 times with the specified brush (see Table B5) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.



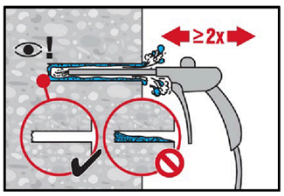
Blow again with compressed air 2 times until return air stream is free of noticeable dust.

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	**Annex B5**
Intended use Installation instructions	

b) Cleaning of diamond cored holes: for all drill hole diameters d_0 and all drill hole depths h_0.

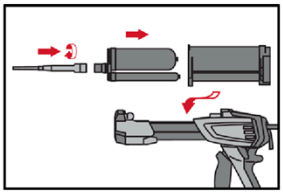


Flush 2 times by inserting a water hose (water-line pressure) to the back of the hole until water runs clear.

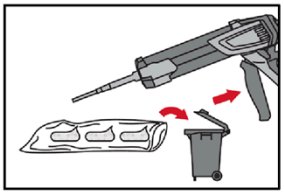


Blow 2 times from the back of the hole (if needed with nozzle extension) with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust and water.

Injection preparation



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

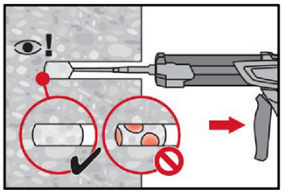


The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive must be discarded. Discarded quantities are:

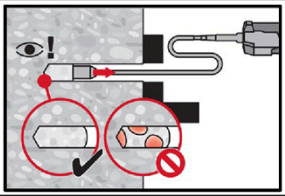
2 strokes	for 330 ml foil pack,
3 strokes	for 500 ml foil pack
4 strokes	for 500 ml foil pack ≤ 5°C.

The minimum temperature of the foil pack is 0°C.

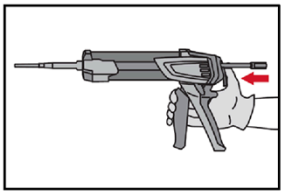
Inject adhesive from the back of the drill hole without forming air voids (through- and pre-setting)



Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull. The quantity of mortar should be selected so that the annular gap in the borehole is filled.

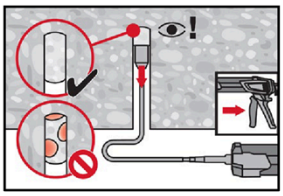


Injection is possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug (see Table B5). Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure. The quantity of mortar should be selected so that the annular gap in the borehole is filled.



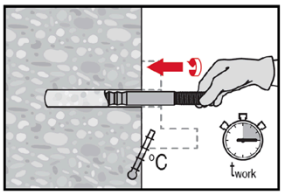
After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	
Intended use Installation instructions	**Annex B6**

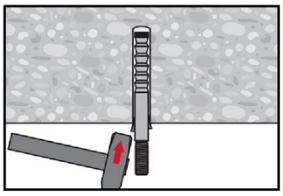


For overhead installation, the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug (see Table B5). Insert piston plug to back of the hole and inject adhesive. During injection, the piston plug will be naturally extruded out of the drill hole by the adhesive pressure.

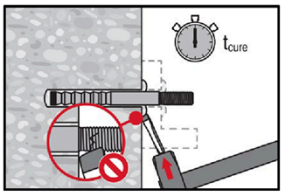
Setting the fastener



Before use, verify that the fastener is dry and free of oil and other contaminants. Set the fastener to the required embedment depth before working time t_{work} (see Table B3 and B4) has elapsed.

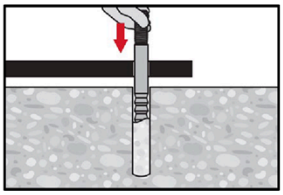


For overhead installation fix embedded parts with e.g. wedges.

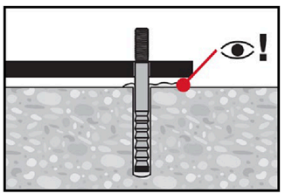


After required curing time t_{cure} (see Table B3 and B4) remove excess mortar.

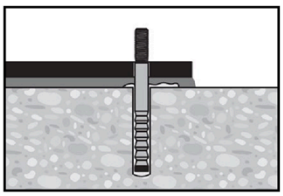
Setting the fastener with clearance between concrete and anchor plate (only if the fastener is loaded in axial direction)



Set the fastener to the required embedment depth before working time t_{work} (see Table B3 and B4) has elapsed.



Check if mortar excess from the borehole.
The annular gap in the fixture does not have to be filled.



After required curing time t_{cure} (see Table B3 and B4) backfill the anchor plate.

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	
Intended use Installation instructions	**Annex B7**

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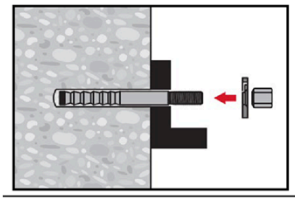
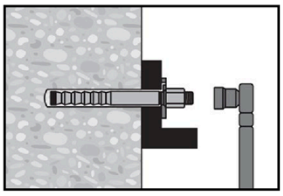
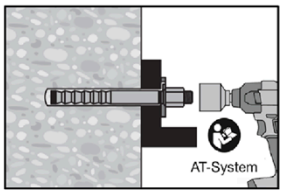
Final assembly with sealing washer



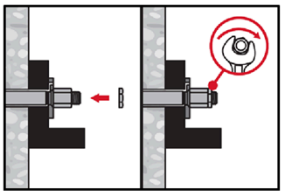
Orient round part of the calotte nut to the sealing washer and install.



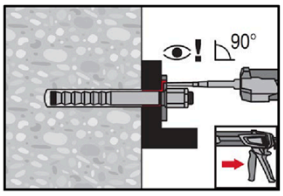
a) Torque wrench
The required installation torque moment is given in Table B1.



b) Machine torqueing
Alternative torqueing is given in Table B2. Read the machine instruction manual from manufacture carefully



Apply the lock nut and tighten with a ¼ to ½ turn.



Fill the annular gap between the anchor rod and fixture completely with Hilti injection mortar HIT-HY 200 or HIT-HY 200 V3. The static mixer nozzle must be put orthogonally on the filling hole. After required curing time t_{cure} (see Table B3 and B4), the fastener can be loaded.

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	**Annex B8**
Intended use Installation instructions	

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Table C1: Essential characteristics under tension load in concrete

HAS-D…				**M12**	**M16**	**M20**
Effective embedment depth		h_{ef}	[mm]	100	125	170
Installation safety factor		γ_{inst}	[-]	1,0		
Steel failure						
Characteristic resistance		$N_{Rk,s}$	[kN]	57	111	188
Partial factor		$\gamma_{Ms,N}$ [1)]	[-]	1,5		
Pull-out failure						
Characteristic bond resistance in uncracked concrete C20/25						
Temperature range: 50 °C / 80 °C		$N_{Rk,p,ucr}$	[kN]	49,2	68,8	109
Characteristic bond resistance in cracked concrete C20/25						
Temperature range: 50 °C / 80 °C		$N_{Rk,p,cr}$	[kN]	34,4	48,1	76,3
Factor for the influence of concrete strength class $N_{Rk,p} = N_{Rk,p,(C20/25)} \cdot \psi_c$		ψ_c	C30/37	1,22		
			C40/50	1,41		
			C50/60	1,58		
Concrete cone failure						
Factor for uncracked concrete		$k_{ucr,N}$	[-]	11,0		
Factor for cracked concrete		$k_{cr,N}$	[-]	7,7		
Edge distance		$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$		
Spacing		$s_{cr,N}$	[mm]	$3,0 \cdot h_{ef}$		
Splitting failure for standard thickness of concrete member						
Standard thickness of concrete member		h	[mm]	200	250	340
Case 1	Edge distance	$c_{cr,sp}$	[mm]	$1,5 \cdot h_{ef}$		
	Spacing	$s_{cr,sp}$	[mm]	$2,0 \cdot c_{cr,sp}$		
	Characteristic resistance in uncracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	40	50	109
Case 2	Edge distance	$c_{cr,sp}$	[mm]	$2,0 \cdot h_{ef}$		$1,5 \cdot h_{ef}$
	Spacing	$s_{cr,sp}$	[mm]	$2,0 \cdot c_{cr,sp}$		
	Characteristic resistance in uncracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	49,2	68,8	109

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D

Performances
Essential characteristics under tension load in concrete

Annex C1

Table C1 continued

Splitting failure for minimum thickness of concrete member						
Minimum thickness of concrete member		h_{min}	[mm]	130	160	220
Case 1	Edge distance	$c_{cr,sp}$	[mm]	$1,5 \cdot h_{ef}$		
	Spacing	$s_{cr,sp}$	[mm]	$2,0 \cdot c_{cr,sp}$		
	Characteristic resistance in uncracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	30	40	75
Case 2	Edge distance	$c_{cr,sp}$	[mm]	$3,0 \cdot h_{ef}$		$2,6 \cdot h_{ef}$
	Spacing	$s_{cr,sp}$	[mm]	$2,0 \cdot c_{cr,sp}$		
	Characteristic resistance in uncracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	49,2	68,8	109

1) In absence of national regulations.

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Table C2: Essential characteristics under shear load in concrete

HAS-D…			M12	M16	M20
Installation factor	γ_{inst}	[-]	1,0		
Steel failure without lever arm					
Characteristic resistance	$V^0_{Rk,s}$	[kN]	34	63	149
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,25		
Ductility factor	k_7		1,0		
Steel failure with lever arm					
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	105	266	519
Partial factor	$\gamma_{Ms,V}$ 1)	[-]	1,25		
Concrete pry-out failure					
Pry-out factor	k_8	[-]	2,0		
Concrete edge failure					
Effective length of fastener	l_f	[mm]	100	125	170
Outside diameter of fastener	d_{nom}	[mm]	14	18	24
Partial factor	γ_{Mc} 1)	[-]	1,5		

1) In absence of national regulations.

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D

Performances
Essential characteristics under shear load in concrete

Annex C3

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Table C3: Displacements under tension load in concrete[1)]

HAS-D…			M12	M16	M20
Uncracked concrete					
Displacement	δ_{N0}-Factor	[mm/kN]	0,017	0,018	0,011
Displacement	$\delta_{N\infty}$-Factor	[mm/kN]	0,054	0,039	0,024
Cracked concrete					
Displacement	δ_{N0}-Factor	[mm/kN]	0,035	0,029	0,021
Displacement	$\delta_{N\infty}$-Factor	[mm/kN]	0,076	0,054	0,034

1) Calculation of the displacement:

$\delta_{N0} = \delta_{N0}$-Faktor · N; $\delta_{N\infty} = \delta_{N\infty}$-Faktor · N; (N: applied tension force).

Table C4: Displacements under shear load in concrete[1)]

HAS-D…			M12	M16	M20
Displacement	δ_{V0}-Factor	[mm/kN]	0,17	0,11	0,057
Displacement	$\delta_{V\infty}$-Factor	[mm/kN]	0,26	0,16	0,087

1) Calculation of the displacement:

$\delta_{V0} = \delta_{V0}$-factor · V; $\delta_{V\infty} = \delta_{V\infty}$-factor · V; (V: applied shear force).

Injection system Hilti HIT-HY 200-A, HIT-HY 200-R, HIT-HY 200-A V3 and HIT-HY 200-R V3 with HAS-D	**Annex C4**
Performances Displacements under tension and shear load in concrete	