

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

**ETA-12/0006**  
**of 26 November 2019**

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 with HIT-Z / HIT-Z-F /  
HIT-Z-R

Product family  
to which the construction product belongs

Bonded expansion fastener for use in concrete

Manufacturer

Hilti AG  
Feldkircherstraße 100  
9494 Schaan  
FÜRSTENTUM LIECHTENSTEIN

Manufacturing plant

Hilti Werke

This European Technical Assessment  
contains

20 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 330499-01-0601

This version replaces

ETA-12/0006 issued on 11 April 2019

**European Technical Assessment**

**ETA-12/0006**

English translation prepared by DIBt

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**Specific Part****1 Technical description of the product**

The injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R is a bonded expansion fastener consisting of a foil pack with injection mortar Hilti HIT-HY 200-A and an anchor rod (including nut and washer) in the sizes of M8, M10, M12, M16 and M20. The anchor rod (including nut and washer) is made of galvanised steel (HIT-Z) with multilayer coating (HIT-Z-F) or stainless steel (HIT-Z-R). The anchor rod is placed into a drill hole filled with injection mortar. The load transfer is realised by mechanical interlock of several cones in the bonding mortar and then via a combination of bonding and friction forces in the base material (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 for static and quasi-static tension load	See Annex C1
Characteristic resistance for static and quasi-static shear load	See Annex C2
Displacements (static and quasi-static loading)	See Annex C3
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C4 – C6
Durability	See Annex B1

**3.2 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 EAD 330499-01-0601 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.

Issued in Berlin on 26 November 2019 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow  
Head of Department

*beglaubigt:*  
Lange

## Installed condition

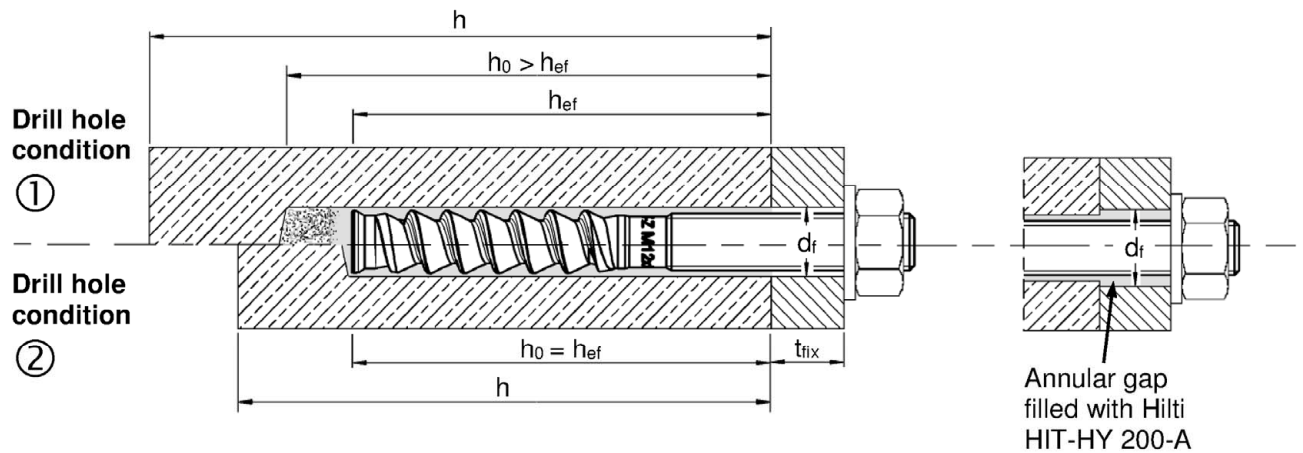
**Figure A1:**  
**HIT-Z, HIT-Z-F, HIT-Z-R**

### Pre-setting:

Install fastener before positioning fixture

### Through-setting:

Install fastener through  
positioned fixture



Drill hole condition ① → non-cleaned drill hole

Drill hole condition ② → drilling dust is removed

**Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R**

**Product description**  
Installed condition

**Annex A1**

**Product description: Injection mortar and fastener**

**Injection mortar Hilti HIT-HY 200-A:** hybrid system with aggregate  
330 ml and 500 ml

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

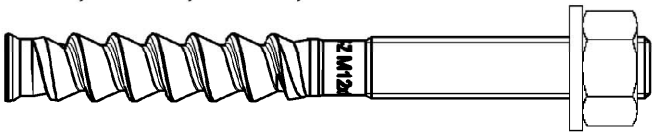


Product name: "Hilti HIT-HY 200-A"

**Static mixer Hilti HIT-RE-M**



**Fastener HIT-Z, HIT-Z-F, HIT-Z-F, HIT-Z-R**



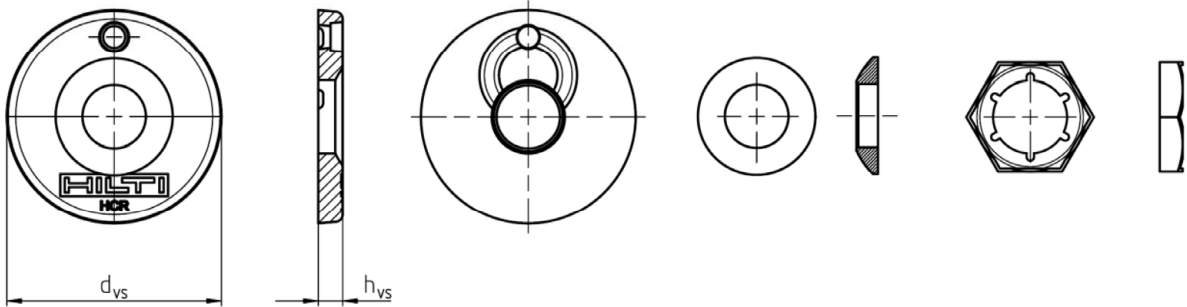
Hilti fastener: HIT-Z and HIT-Z-R: M8 to M20  
Hilti fastener: HIT-Z-F: M16 and M20

**Hilti Filling Set** to fill the annular gap between fastener and fixture

Sealing washer

Spherical washer

Lock nut



**Table A1: Geometry of Hilti filling set**

Hilti Filling Set			M16	M20
Diameter of sealing washer	d <sub>vs</sub>	[mm]	52	60
Thickness of sealing washer	h <sub>vs</sub>	[mm]	6	
Thickness of Hilti Filling Set	h <sub>rs</sub>	[mm]	11	13

**Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R**

**Product description**

Injection mortar / Static mixer / Fastener / Filling set

**Annex A2**

**Table A2: Materials**

Designation	Material
<b>Metal parts made of zinc coated steel</b>	
Fastener HIT-Z	For $\leq M12$ : $f_{uk} = 650 \text{ N/mm}^2$ , $f_{yk} = 520 \text{ N/mm}^2$ , For $M16$ : $f_{uk} = 610 \text{ N/mm}^2$ , $f_{yk} = 490 \text{ N/mm}^2$ , For $M20$ : $f_{uk} = 595 \text{ N/mm}^2$ , $f_{yk} = 480 \text{ N/mm}^2$ , Elongation at fracture ( $l_0=5d$ ) $> 8\%$ ductile Electroplated zinc coated $\geq 5 \mu\text{m}$
Washer	Electroplated zinc coated $\geq 5 \mu\text{m}$
Nut	Strength class of nut adapted to strength class of fastener Electroplated zinc coated $\geq 5 \mu\text{m}$
Hilti Filling Set	Sealing washer: Electroplated zinc coated $\geq 5 \mu\text{m}$ Spherical washer: Electroplated zinc coated $\geq 5 \mu\text{m}$ Lock nut: Electroplated zinc coated $\geq 5 \mu\text{m}$
<b>Metal parts made of multilayer coating steel</b>	
Fastener HIT-Z-F	For $M16$ : $f_{uk} = 610 \text{ N/mm}^2$ , $f_{yk} = 490 \text{ N/mm}^2$ , For $M20$ : $f_{uk} = 595 \text{ N/mm}^2$ , $f_{yk} = 480 \text{ N/mm}^2$ , Elongation at fracture ( $l_0=5d$ ) $> 8\%$ ductile; Multilayer coating, ZnNi-galvanized according to DIN 50979:2008-07
Washer	Multilayer coating, ZnNi-galvanized according to DIN 50979:2008-07
Nut	Multilayer coating, ZnNi-galvanized according to DIN 50979:2008-07
Hilti Filling Set ...-F	Sealing washer: hot dip galvanized $\geq 45 \mu\text{m}$ Spherical washer: hot dip galvanized $\geq 45 \mu\text{m}$ Lock nut: hot dip galvanized $\geq 45 \mu\text{m}$
<b>Metal parts made of stainless steel corrosion resistance class III according EN 1993-1-4:2006+A1:2015</b>	
Fastener HIT-Z-R	For $\leq M12$ : $f_{uk} = 650 \text{ N/mm}^2$ , $f_{yk} = 520 \text{ N/mm}^2$ , For $M16$ : $f_{uk} = 610 \text{ N/mm}^2$ , $f_{yk} = 490 \text{ N/mm}^2$ , For $M20$ : $f_{uk} = 595 \text{ N/mm}^2$ , $f_{yk} = 480 \text{ N/mm}^2$ , Elongation at fracture ( $l_0=5d$ ) $> 8\%$ ductile Stainless steel 1.4401, 1.4404 EN 10088-1:2014
Washer	Stainless steel A4 according to EN 10088-1:2014
Nut	Strength class of nut adapted to strength class of fastener Stainless steel 1.4401, 1.4404 EN 10088-1:2014
Hilti Filling Set	Sealing washer: stainless steel Spherical washer: stainless steel Lock nut: stainless steel

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

**Product description**  
Materials

**Annex A3**

## Specifications of intended use

### Anchorage subject to:

- Static and quasi static loading
  - HIT-Z and HIT-Z-R size M8 to M20. HIT-Z-F sizes M16 and M20
- Seismic performance category:
  - Seismic C1: HIT-Z, HIT-Z-R sizes M8 to M20, HIT-Z-F sizes M16 and M20 in hammer drilled holes.
  - Seismic C2: HIT-Z, HIT-Z-R sizes M12 to M20, HIT-Z-F sizes M16 and M20 in hammer drilled holes.

### Base material:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206-1:2013+A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206-1:2013+A1:2016.
- Cracked and uncracked concrete.

### Temperature in the base material:

- at installation
  - +5 °C to +40 °C for the standard variation of temperature after installation
- in-service
  - Temperature range I: -40 °C to +40 °C  
(max. long term temperature +24 °C and max. short term temperature +40 °C)
  - Temperature range II: -40 °C to +80 °C  
(max. long term temperature +50 °C and max. short term temperature +80 °C)
  - Temperature range III: -40 °C to +120 °C  
(max. long term temperature +72 °C and max. short term temperature +120 °C)

### Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials)
- For all other conditions according EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance class Table A2 Annex A3 (stainless steels)

### Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e. g. position of the fastener relative to reinforcement or to supports, etc.).
- The anchorages are designed in accordance with EN 1992-4:2018 and EOTA Technical Report TR 055.

### Installation:

- Concrete condition I1: Installation in dry or wet (water saturated) concrete and use in service in dry or wet concrete
- Installation direction D3: downward and horizontal and upward (e.g. overhead).
- Drilling technique: hammer drilling, diamond coring or hammer drilling with hollow drill bit TE-CD, TE-YD
- 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 with HIT-Z / HIT-Z-F / HIT-Z-R

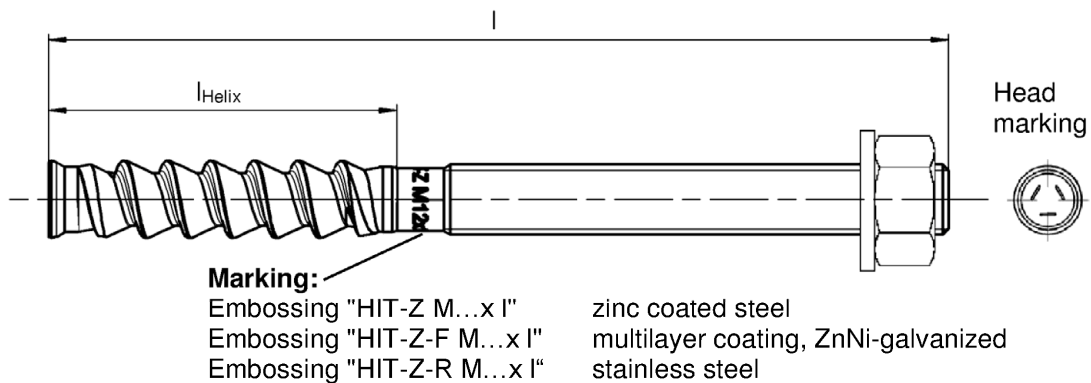
Intended Use  
Specifications

Annex B1



**Table B1: Installation parameters HIT-Z, HIT-Z-F and HIT-Z-R**

				M8	M10	M12	M16	M20
Nominal diameter	d	[mm]		8	10	12	16	20
Nominal diameter of drill bit	d <sub>0</sub>	[mm]		10	12	14	18	22
Length of fastener	min l	[mm]		80	95	105	155	215
	max l	[mm]		120	160	196	420	450
Length of helix	l <sub>Helix</sub>	[mm]		50	60	60	96	100
Nominal anchorage depth	h <sub>ef,min</sub>	[mm]		60	60	60	96	100
	h <sub>ef,max</sub>	[mm]		100	120	144	192	220
Drill hole condition ① Min. thickness of concrete member	h <sub>min</sub>	[mm]		h <sub>ef</sub> + 60 mm			h <sub>ef</sub> + 100 mm	
Drill hole condition ② Min. thickness of concrete member	h <sub>min</sub>	[mm]		h <sub>ef</sub> + 30 mm ≥ 100 mm			h <sub>ef</sub> + 45 mm	
Maximum depth of drill hole	h <sub>0</sub>	[mm]		h – 30 mm			h – 2 d <sub>0</sub>	
Pre-setting: Maximum diameter of clearance hole in the fixture	d <sub>f</sub>	[mm]		9	12	14	18	22
Through-setting: Maximum diameter of clearance hole in the fixture	d <sub>f</sub>	[mm]		11	14	16	20	24
Maximum fixture thickness	t <sub>fix</sub>	[mm]		48	87	120	303	326
Maximum fixture thickness with Hilti filling set	t <sub>fix</sub>	[mm]		41	79	111	292	314
Installation torque moment	HIT-Z, HIT-Z-F	T <sub>inst</sub>	[Nm]	10	25	40	80	150
	HIT-Z-R	T <sub>inst</sub>	[Nm]	30	55	75	155	215



Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

**Intended Use**  
Installation parameters

**Annex B2**

## Minimum edge distance and spacing

For the calculation of minimum spacing and minimum edge distance of fasteners in combination with different embedment depth and thickness of concrete member the following equation shall be fulfilled:

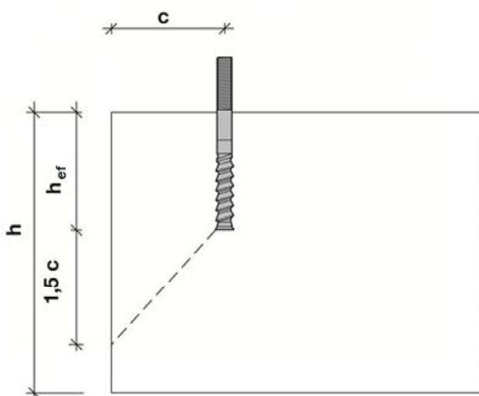
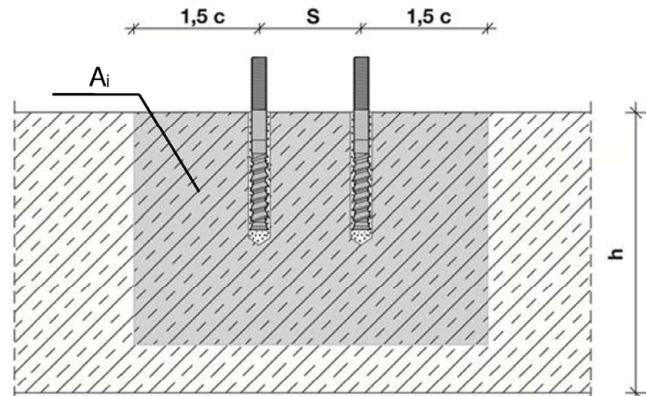
$$A_{i,req} < A_{i,ef}$$

**Table B2: Required area  $A_{i,req}$**

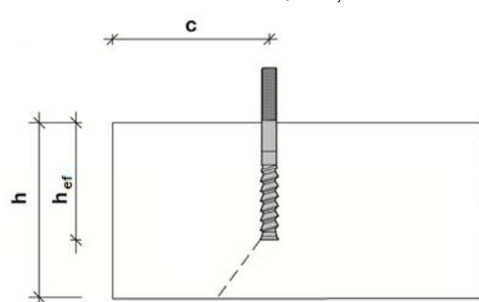
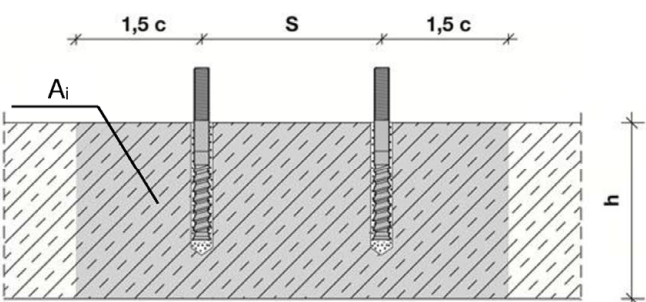
			M8	M10	M12	M16	M20
Cracked concrete	$A_{i,req}$	[mm <sup>2</sup> ]	19200	40800	58800	94700	148000
Non-cracked concrete	$A_{i,req}$	[mm <sup>2</sup> ]	22200	57400	80800	128000	198000

**Table B3: Effective area  $A_{i,ef}$**

Member thickness  $h > h_{ef} + 1,5 \cdot c$

			
Single fastener and group of fasteners with $s > 3 \cdot c$	[mm <sup>2</sup> ]	$A_{i,ef} = (6 \cdot c) \cdot (h_{ef} + 1,5 \cdot c)$	with $c \geq 5 \cdot d$
Group of fasteners with $s \leq 3 \cdot c$	[mm <sup>2</sup> ]	$A_{i,ef} = (3 \cdot c + s) \cdot (h_{ef} + 1,5 \cdot c)$	with $c \geq 5 \cdot d$ and $s \geq 5 \cdot d$

Member thickness  $h \leq h_{ef} + 1,5 \cdot c$

			
Single fastener and group of fasteners with $s > 3 \cdot c$	[mm <sup>2</sup> ]	$A_{i,ef} = (6 \cdot c) \cdot h$	with $c \geq 5 \cdot d$
Group of fasteners with $s \leq 3 \cdot c$	[mm <sup>2</sup> ]	$A_{i,ef} = (3 \cdot c + s) \cdot h$	with $c \geq 5 \cdot d$ and $s \geq 5 \cdot d$

$c_{min}$  and  $s_{min}$  in 5 mm steps

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

Intended Use






Installation parameters: member thickness, spacing and edge distances

Annex B3

**Table B4: Maximum working time and minimum curing time**

Temperature in the base material T	Maximum working time $t_{\text{work}}$	Minimum curing time $t_{\text{cure}}$
5 °C	25 min	2 hours
6 °C to 10 °C	15 min	75 min
11 °C to 20 °C	7 min	45 min
21 °C to 30 °C	4 min	30 min
31 °C to 40 °C	3 min	30 min

**Table B5: Parameters of drilling and setting tools**

Fastener	Drill			Installation
	Hammer drilling		Diamond coring	Piston plug
HIT-Z / HIT-Z(-F,-R)	Drill bit	Hollow drill bit TE-CD, TE-YD		
				
size	$d_0$ [mm]	$d_0$ [mm]	$d_0$ [mm]	HIT-SZ
M8	10	-	10	-
M10	12	12	12	12
M12	14	14	14	14
M16	18	18	18	18
M20	22	22	22	22

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

**Intended Use**

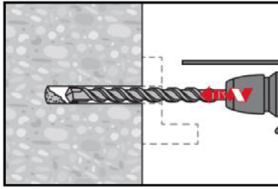
Maximum working time and minimum working time  
Cleaning and setting tools

**Annex B4**

## Installation instruction

### Hole drilling

#### a) Hammer drilling

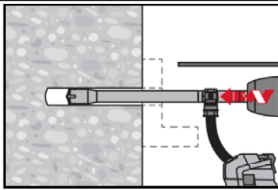


**Through-setting:** Drill hole through the clearance hole in the fixture to the required drilling depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

**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.

After drilling is complete, proceed to the "injection preparation" step in the installation instruction.

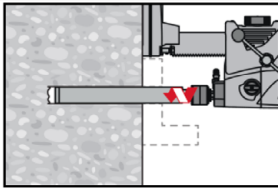
#### b) Hammer drilling with hollow drill bit



**Pre- / Through-setting:** 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 (see Annex A1 – Drill hole condition ②).

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.

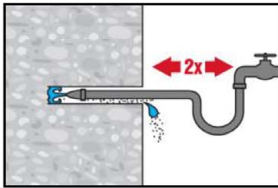
**Through-setting:** Drill hole through the clearance hole in the fixture to the required drilling depth.

**Pre-setting:** Drill hole to the required embedment depth.

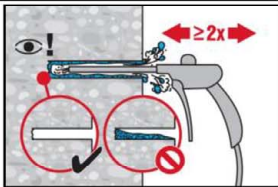
### Drill hole cleaning

a) No cleaning required for hammer drilled holes.

b) Hole flushing and evacuation required for wet-drilled diamond cored holes.



Flush 2 times from the back of the hole over the whole length until water runs clear. Water-line pressure is sufficient.



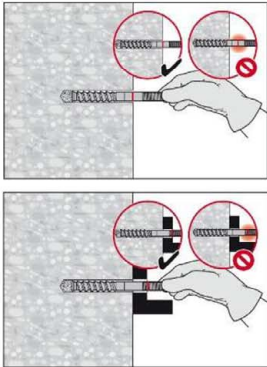
Blow 2 times from the back of the hole (if needed with nozzle extension) with oil-free compressed air (min. 6 bar at 6 m³/h) to evacuate the water.

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

Intended Use  
Installation instructions

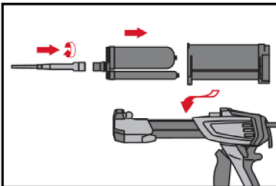
Annex B5

### Checking of setting depth

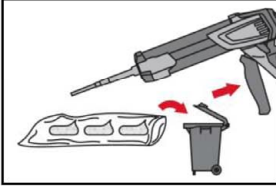


Mark the element and check the setting depth. The element has to fit in the hole until the required embedment depth. If it is not possible to insert the element to the required embedment depth, remove the dust in the drill hole or drill deeper.

### Injection preparation



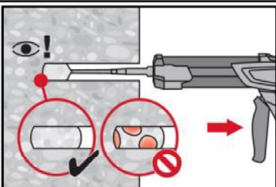
Tightly attach Hilti mixing nozzle HIT-RE-M to foil pack manifold. Do not modify the mixing nozzle.  
Observe the instruction for use of the dispenser.  
Check foil pack holder for proper function. Insert foil pack into foil pack holder and put holder into the dispenser.



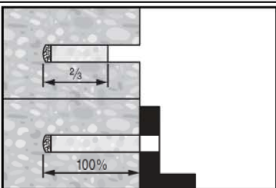
The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded. Discarded quantities are:

2 strokes	for 330 ml foil pack,
3 strokes	for 500 ml foil pack.

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

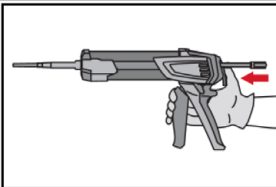


Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull.



Pre-setting: Fill approximately 2/3 of the drill hole.

Through-setting: Fill 100% of the drill hole



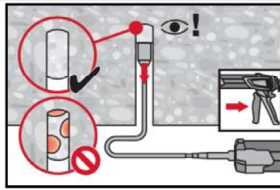
After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

Intended Use  
Installation instructions

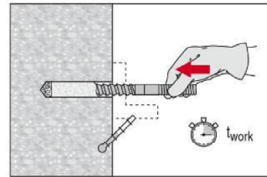
Annex B6

### Overhead installation

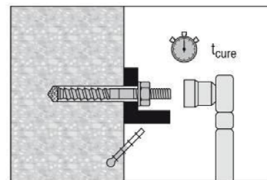


For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug (see Table B5). Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally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

### Setting the element

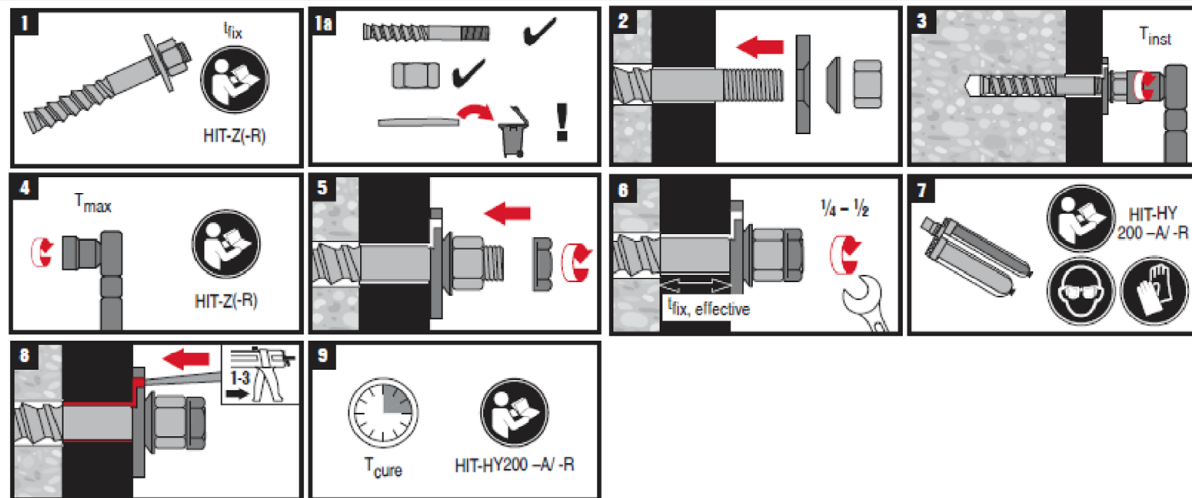


Before use, verify that the element is dry and free of oil and other contaminants. Set element to the required embedment depth before working time  $t_{work}$  has elapsed. The working time  $t_{work}$  is given in Table B4. After setting the element the annular gap between the fastener and the fixture (through-setting) or concrete (pre-setting) has to be filled with mortar.



After required curing time  $t_{cure}$  (see Table B4) remove excess mortar. The required installation torque  $T_{inst}$  is given in Table B1. The fastener can be loaded.

### Installation with Hilti filling set




Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

Intended Use  
Installation instructions

Annex B7



**Table C1: Essential characteristics for HIT-Z (-F, -R), under tension load in case of static and quasi static loading**

			M8	M10	M12	M16	M20
Installation safety factor $\gamma_{inst}$ [-]			1,0				
Steel failure							
HIT-Z, HIT-Z-F	$N_{Rk,s}$	[kN]	24	38	55	96	146
HIT-Z-R	$N_{Rk,s}$	[kN]	24	38	55	96	146
Pull-out failure							
in uncracked concrete							
Temperature range I: 40 °C / 24 °C	$N_{Rk,p,ucr}$	[kN]	30	44	50	115	150
Temperature range II: 80 °C / 50 °C	$N_{Rk,p,ucr}$	[kN]	26	40	48	105	135
Temperature range III: 120 °C / 72 °C	$N_{Rk,p,ucr}$	[kN]	24	36	44	95	125
in cracked concrete							
Temperature range I: 40 °C / 24 °C	$N_{Rk,p,cr}$	[kN]	26	40	48	105	135
Temperature range II: 80 °C / 50 °C	$N_{Rk,p,cr}$	[kN]	24	36	44	95	125
Temperature range III: 120 °C / 72 °C	$N_{Rk,p,cr}$	[kN]	22	32	40	85	110
Concrete cone failure							
Effective embedment depth	$h_{ef,min}$	[mm]	60	60	60	96	100
	$h_{ef,max}$	[mm]	100	120	144	192	220
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							
Edge distance $c_{cr,sp}$ [mm] for	$h / h_{ef} \geq 2,35$	$1,5 \cdot h_{ef}$					
	$2,35 > h / h_{ef} > 1,35$	$6,2 \cdot h_{ef} - 2,0 \cdot h$					
	$h / h_{ef} \leq 1,35$	$3,5 \cdot h_{ef}$					
Spacing	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$				

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

**Performances**

Essential characteristics under tension load in case of static and quasi static loading

**Annex C1**

**Table C2: Essential characteristics for HIT-Z (-F, -R) under shear load for static and quasi static loading**

		M8	M10	M12	M16	M20
Installation safety factor	$\gamma_{\text{inst}}$ [-]	1,0				
Steel failure without lever arm						
HIT-Z, HIT-Z-F	$V_{\text{Rk,s}}$ [kN]	12	19	27	48	73
HIT-Z-R	$V_{\text{Rk,s}}$ [kN]	14	23	33	57	88
Ductility factor	$k_7$ [-]	1,0				
Steel failure with lever arm						
HIT-Z, HIT-Z-F	$M^0_{\text{Rk,s}}$ [Nm]	24	49	85	203	386
HIT-Z-R	$M^0_{\text{Rk,s}}$ [Nm]	24	49	85	203	386
Ductility factor	$k_7$ [-]	1,0				
Concrete pry-out failure						
Pry-out factor	$k_8$ [-]	2,0				
Concrete edge failure						
Effective length of fastener in shear loading	$l_f$ [mm]	$h_{\text{ef}}$				
Diameter of fastener	$d_{\text{nom}}$ [mm]	8	10	12	16	20

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

**Performances**

Essential characteristics under shear load in case of static and quasi static loading

**Annex C2**



**Table C3: Displacements under tension load for HIT-Z (-F, -R) for static and quasi static loading<sup>1)</sup>**

			M8	M10	M12	M16	M20
<b>Uncracked concrete, Temperature range I: 40 °C / 24 °C</b>							
Displacement	$\delta_{N0}$ -factor	[mm/kN]	0,03	0,03	0,04	0,05	0,07
	$\delta_{N\infty}$ -factor	[mm/kN]	0,06	0,08	0,10	0,13	0,17
<b>Uncracked concrete, Temperature range II: 80 °C / 50 °C</b>							
Displacement	$\delta_{N0}$ -factor	[mm/kN]	0,03	0,04	0,04	0,06	0,07
	$\delta_{N\infty}$ -factor	[mm/kN]	0,07	0,09	0,11	0,15	0,18
<b>Uncracked concrete, Temperature range III: 120 °C / 72 °C</b>							
Displacement	$\delta_{N0}$ -factor	[mm/kN]	0,03	0,04	0,05	0,06	0,08
	$\delta_{N\infty}$ -factor	[mm/kN]	0,07	0,10	0,12	0,16	0,20
<b>Cracked concrete, Temperature range I: 40 °C / 24 °C</b>							
Displacement	$\delta_{N0}$ -factor	[mm/kN]	0,06	0,07	0,08	0,09	0,10
	$\delta_{N\infty}$ -factor	[mm/kN]	0,21	0,21	0,21	0,21	0,21
<b>Cracked concrete, Temperature range II: 80 °C / 50 °C</b>							
Displacement	$\delta_{N0}$ -factor	[mm/kN]	0,07	0,08	0,08	0,10	0,11
	$\delta_{N\infty}$ -factor	[mm/kN]	0,23	0,23	0,23	0,23	0,23
<b>Cracked concrete, Temperature range III: 120 °C / 72 °C</b>							
Displacement	$\delta_{N0}$ -factor	[mm/kN]	0,07	0,08	0,09	0,11	0,12
	$\delta_{N\infty}$ -factor	[mm/kN]	0,25	0,25	0,25	0,25	0,25

<sup>1)</sup> Calculation of the displacement

$$\delta_{N0} = \delta_{N0\text{-factor}} \cdot N; \quad \delta_{N\infty} = \delta_{N\infty\text{-factor}} \cdot N; \quad (N: \text{action tension load}).$$

**Table C4: Displacements under shear load for HIT-Z (-F, -R) for static and quasi static loading<sup>1)</sup>**

			M8	M10	M12	M16	M20
Displacement	$\delta_{V0}$ -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04
	$\delta_{V\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06

<sup>1)</sup> Calculation of the displacement

$$\delta_{V0} = \delta_{V0\text{-factor}} \cdot V; \quad \delta_{V\infty} = \delta_{V\infty\text{-factor}} \cdot V; \quad (V: \text{action shear load})$$

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

**Performances**

Displacements in case of static and quasi-static loading

**Annex C3**

**Table C5: Essential characteristics under tension load for HIT-Z (-F, -R) for seismic performance category C1**

			M8	M10	M12	M16	M20	
Installation safety factor	$\gamma_{inst}$	[-]	1,0					
Steel failure								
HIT-Z, HIT-Z-F	$N_{Rk,s,seis}$	[kN]	24	38	55	96	146	
HIT-Z-R	$N_{Rk,s,seis}$	[kN]	24	38	55	96	146	
Pull-out failure								
in cracked concrete C20/25								
Temperature range I:	40 °C / 24 °C	$N_{Rk,p,seis}$	[kN]	26	38	46	100	130
Temperature range II:	80 °C / 50 °C	$N_{Rk,p,seis}$	[kN]	22	34	42	90	115
Temperature range III:	120 °C / 72 °C	$N_{Rk,p,seis}$	[kN]	20	32	38	80	105

**Table C6: Essential characteristics under shear load for HIT-Z (-F, -R) for seismic performance category C1**

		M8	M10	M12	M16	M20
<b>Steel failure</b>						
HIT-Z, HIT-Z-F	$V_{Rk,s,seis}$ [kN]	7	17	16	28	45
HIT-Z-R	$V_{Rk,s,seis}$ [kN]	8	19	22	31	48

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

**Performances**

Essential characteristics – seismic performance category C1

**Annex C4**

**Table C7: Essential characteristics for HIT-Z (-F, -R) under tension load for seismic performance category C2**

	M8	M10	M12	M16	M20
Installation safety factor $\gamma_{\text{inst}}$ [-]	1,0				
Steel failure					
HIT-Z, HIT-Z-F $N_{\text{Rk,s,seis}}$ [kN]	-	-	55	96	146
HIT-Z-R $N_{\text{Rk,s,seis}}$ [kN]	-	-	55	96	146
Pull-out failure					
in cracked concrete C20/25					
Temperature range I: 40 °C / 24 °C $N_{\text{Rk,p,seis}}$ [kN]	-	-	22	70	100
Temperature range II: 80 °C / 50 °C $N_{\text{Rk,p,seis}}$ [kN]	-	-	19	60	80
Temperature range III: 120 °C / 72 °C $N_{\text{Rk,p,seis}}$ [kN]	-	-	16	50	70

**Table C8: Essential characteristics under shear load for HIT-Z (-F, -R) for seismic performance category C2**

		M8	M10	M12	M16	M20
<b>Steel failure</b>						
Installation without Hilti filling set						
Effective embedment depth	$h_{ef}$ [mm]	-	-	< 96	< 125	< 150
HIT-Z, HIT-Z-F	$V_{Rk,s,seis}$ [kN]	-	-	11	17	35
HIT-Z-R	$V_{Rk,s,seis}$ [kN]	-	-	16	21	35
Effective embedment depth	$h_{ef}$ [mm]	-	-	≥ 96	≥ 125	≥ 150
HIT-Z* (-F, -R)	$V_{Rk,s,seis}$ [kN]	-	-	21	36	55
Installation with Hilti filling set						
Effective embedment depth	$h_{ef}$ [mm]	-	-	< 96	< 125	< 150
HIT-Z* (-F, -R)	$V_{Rk,s,seis}$ [kN]	-	-	20	34	40
Effective embedment depth	$h_{ef}$ [mm]	-	-	≥ 96	≥ 125	≥ 150
HIT-Z* (-F, -R)	$V_{Rk,s,seis}$ [kN]	-	-	23	41	61

\*These values apply only for steel element shorter than HIT-Z M16x280 and HIT-Z M20x300.

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

**Performances**  
Essential characteristics – seismic performance category C2

**Annex C5**

**Table C9: Displacements under tension load for HIT-Z (-F, -R) for seismic performance category C2**

			M8	M10	M12	M16	M20
Displacement DLS	$\delta_{N,seis(DLS)}$	[mm]	-	-	1,3	1,9	1,2
Displacement ULS	$\delta_{N,seis(ULS)}$	[mm]	-	-	3,2	3,6	2,6

**Table C10: Displacements under shear load for HIT-Z (-F, -R) for seismic performance category C2**

			M8	M10	M12	M16	M20
Installation without Hilti filling set							
Effective embedment depth	$h_{ef}$	[mm]	-	-	< 96	< 125	< 150
Displacement DLS HIT-Z, HIT-Z-F	$\delta_{V,seis(DLS)}$	[mm]	-	-	2,8	3,1	4,9
Displacement ULS HIT-Z, HIT-Z-F	$\delta_{V,seis(ULS)}$	[mm]	-	-	4,6	6,2	6,8
Displacement DLS HIT-Z-R	$\delta_{V,seis(DLS)}$	[mm]	-	-	3,0	3,1	4,9
Displacement ULS HIT-Z-R	$\delta_{V,seis(ULS)}$	[mm]	-	-	6,2	6,2	6,8
Effective embedment depth	$h_{ef}$	[mm]	-	-	≥ 96	≥ 125	≥ 150
Displacement DLS HIT-Z (-F, -R)	$\delta_{V,seis(DLS)}$	[mm]	-	-	3,4	3,6	1,8
Displacement ULS HIT-Z (-F, -R)	$\delta_{V,seis(ULS)}$	[mm]	-	-	6,0	5,9	5,8
Installation with Hilti filling set							
Effective embedment depth	$h_{ef}$	[mm]	-	-	< 96	< 125	< 150
Displacement DLS HIT-Z (-F, -R)	$\delta_{V,seis(DLS)}$	[mm]	-	-	1,4	1,7	1,8
Displacement ULS HIT-Z (-F, -R)	$\delta_{V,seis(ULS)}$	[mm]	-	-	4,4	5,1	5,6
Effective embedment depth	$h_{ef}$	[mm]	-	-	≥ 96	≥ 125	≥ 150
Displacement DLS HIT-Z (-F, -R)	$\delta_{V,seis(DLS)}$	[mm]	-	-	1,4	1,7	4,6
Displacement ULS HIT-Z (-F, -R)	$\delta_{V,seis(ULS)}$	[mm]	-	-	5,2	5,1	7,0

Injection system Hilti HIT-HY 200-A with HIT-Z / HIT-Z-F / HIT-Z-R

**Performances**  
Displacements for seismic performance category C2

**Annex C6**