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-19/0802 of 15 April 2020

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	Hilti bonded expansion anchor HIT-Z-(R)-D TP
Product family to which the construction product belongs	Post-installed fasteners in concrete under fatigue cyclic loading
Manufacturer	Hilti Aktiengesellschaft Feldkircherstrasse 100 9494 SCHAAN FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	Hilti Werke Hilti Plants
This European Technical Assessment contains	17 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 330250-00-0601

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Specific Part

1 Technical description of the product

The Hilti bonded expansion anchor HIT-Z-(R)-D TP is a bonded expansion anchor consisting of a cartridge with injection mortar Hilti HIT-HY 200-A, a fastener HIT-Z-D TP with a lock nut, a calotte nut and a Hilti sealing washer or a fastener HIT-Z-R-D TP with a lock nut, a hexagon nut, a spherical washer and a Hilti sealing washer.

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 fatigue resistance under cyclic tension loading (Assessment method A)	
Characteristic steel fatigue resistance	See Annexes C1 and C3
Characteristic concrete cone and splitting fatigue resistance	
Characteristic combined pull- out /concrete cone fatigue resistance	
Characteristic fatigue resistance under cyclic shear loading (Assessment method A)	
Characteristic steel fatigue resistance	See Annexes C2 and C3
Characteristic concrete edge fatigue resistance	
Characteristic concrete pry out fatigue resistance	

Essential characteristic	Performance
Characteristic fatigue resistance under cyclic combined tension and shear loading (Assessment method A)	
Characteristic steel fatigue resistance	See Annexes C4
Load transfer factor for cyclic tension and shear loading	
Load transfer factor	See Annexes C1 to C3

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

In accordance with European Assessment Document No. 330250-00-0601, 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 15 April 2020 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Baderschneider

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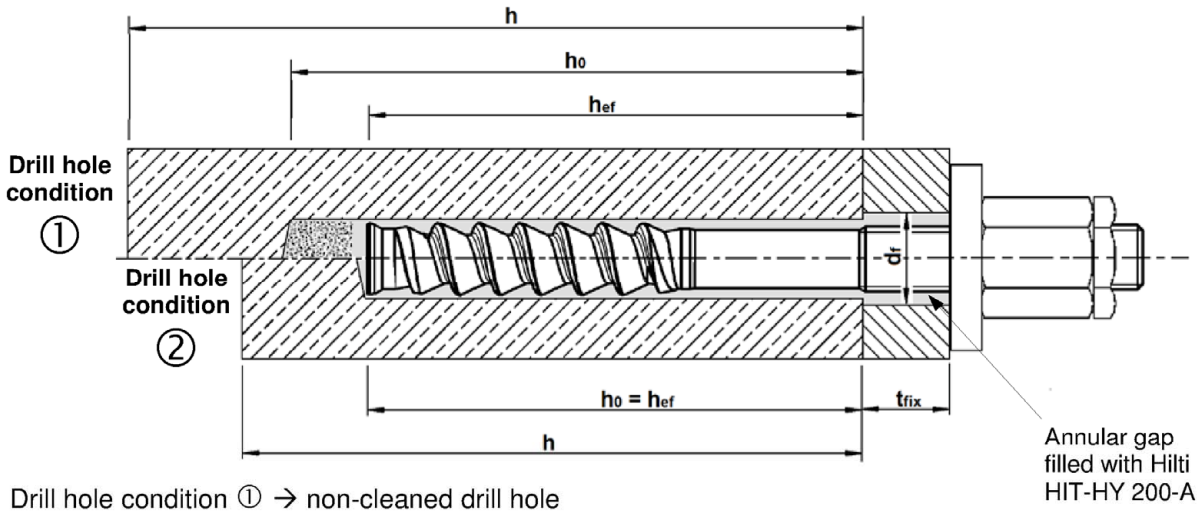
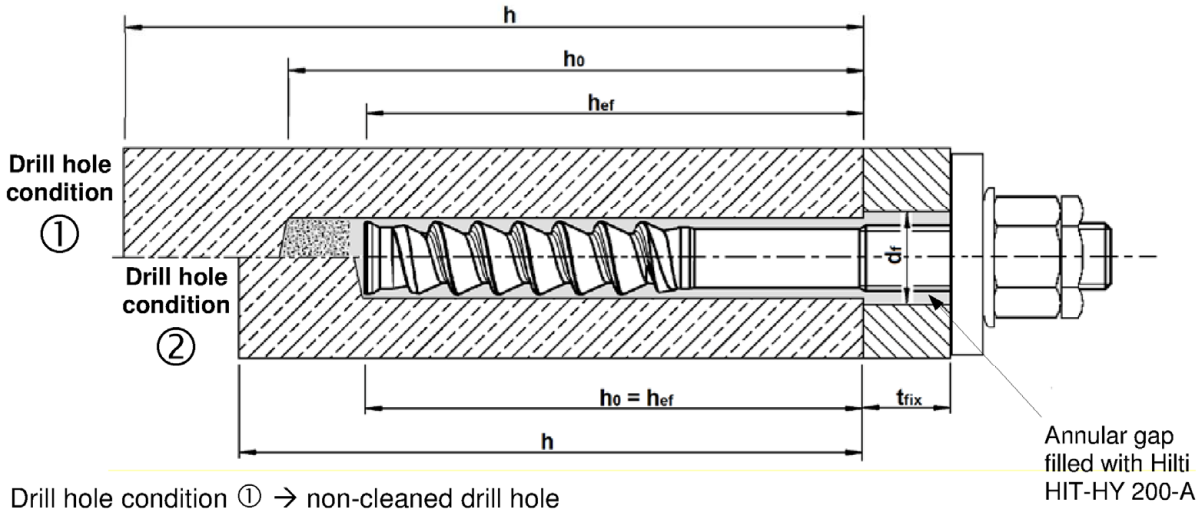
Installed condition

Figure A1:
HIT-Z-D TP



Drill hole condition ① → non-cleaned drill hole
Drill hole condition ② → drilling dust is removed

Figure A2:
HIT-Z-R-D TP



Drill hole condition ① → non-cleaned drill hole
Drill hole condition ② → drilling dust is removed

Hilti bonded expansion anchor HIT-Z-(R)-D TP	Annex A1
Product description Installed condition	

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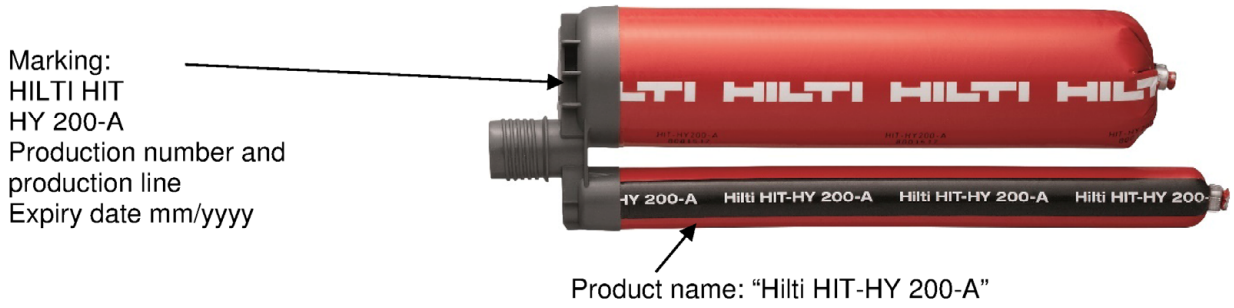
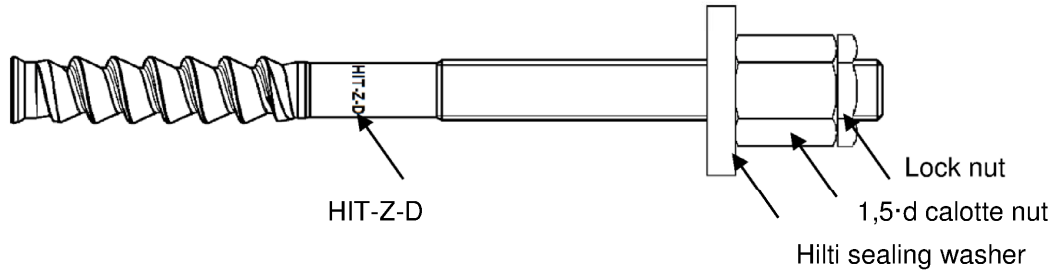
Product description: injection mortar and fastener

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

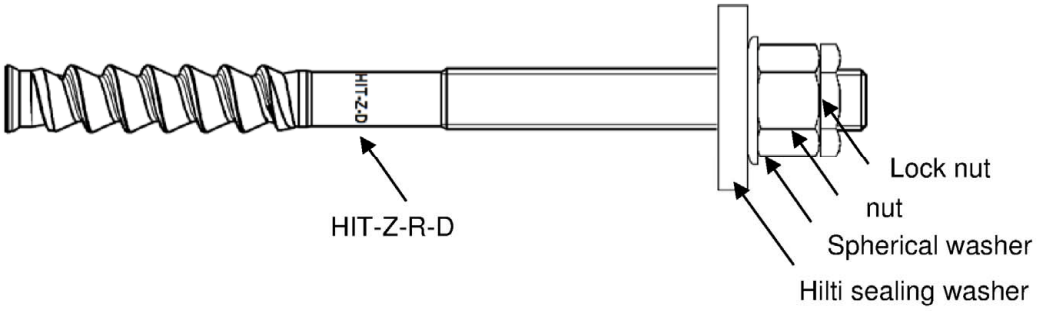


Static mixer Hilti HIT-RE-M

Fastener HIT-Z-D TP M16



Fastener HIT-Z-R-D TP M16



Hilti bonded expansion anchor HIT-Z-(R)-D TP	Annex A2
Product description Product parts	

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

Sealing washer Spherical washer Lock nut

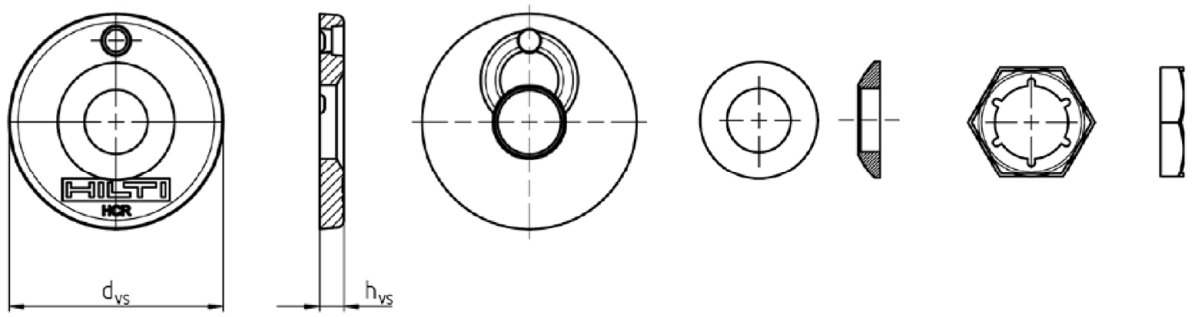

Table A1: Geometry of Hilti sealing washer

Size			M16
Diameter of sealing washer	d_{vs}	[mm]	52
Thickness of sealing washer	h_{vs}	[mm]	6

Table A2: Materials

Designation	Material
Metal parts made of zinc coated steel	
Anchor rod HIT-Z-D TP M16	f_{uk} = 610 N/mm²; f_{yk} = 490 N/mm² Elongation at fracture (l_0=5d) > 8% ductile Electroplated zinc coated ≥ 5 µm
Sealing washer	Spherical washer G19 DIN 6319: 2001 Electroplated zinc coated ≥ 5 µm
Calotte nut	Hexagon nut with a height of 1,5 d DIN 6330: 2003 Electroplated zinc coated ≥ 5 µm
Lock nut	Self locking counter nut DIN 7967: 1970 Electroplated zinc coated ≥ 5 µm
Metal parts made of stainless steel Corrosion resistance class III according EN 1993-1-4:2006+A1:2015	
Anchor rod HIT-Z-R-D TP M16	f_{uk} = 610 N/mm²; f_{yk} = 490 N/mm² Elongation at fracture (l_0=5d) > 8% ductile Stainless steel 1.4401, 1.4404 EN 10088-1:2014
Sealing washer	Spherical washer G19 DIN 6319: 2001 Stainless steel A4 EN 10088-1:2014
Spherical washer	Stainless steel 1.4401, 1.4404 EN 10088-1:2014
Hexagon Nut	DIN EN ISO 3506-2:2010, Grade 80, Stainless steel 1.4401, 1.4404 EN 10088-1:2014
Lock nut	Self locking counter nut DIN 7967: 1970 Stainless steel A4 EN 10088-1:2014

Hilti bonded expansion anchor HIT-Z-(R)-D TP

Product description
Product parts and materials

Annex A3

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Specifications of intended use

Anchorages subject to:

- Fatigue cycling loading.

Note: static and quasi-static load according to ETA-15/0296.

Base material:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013.
- Strength classes C20/25 to C50/60 according to EN 206:2013.
- 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)
- Structures subject to external atmospheric exposure including industrial and marine environment or exposure to permanently damp internal conditions, if no particular aggressive conditions exist (Stainless Steel A4).
  Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

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 anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages under fatigue cycling loading are designed in accordance with:
  EN 1992-4:2018 and EOTA TR 061:2017 (Design method I and II)

Installation:

- Use category: dry or wet concrete (not in flooded holes)
- Drilling technique: hammer drilling, hammer drilling with hollow drill bit TE-CD, TE-YD, diamond coring
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

Hilti bonded expansion anchor HIT-Z-(R)-D TP	**Annex B1**
Intended use Specifications	

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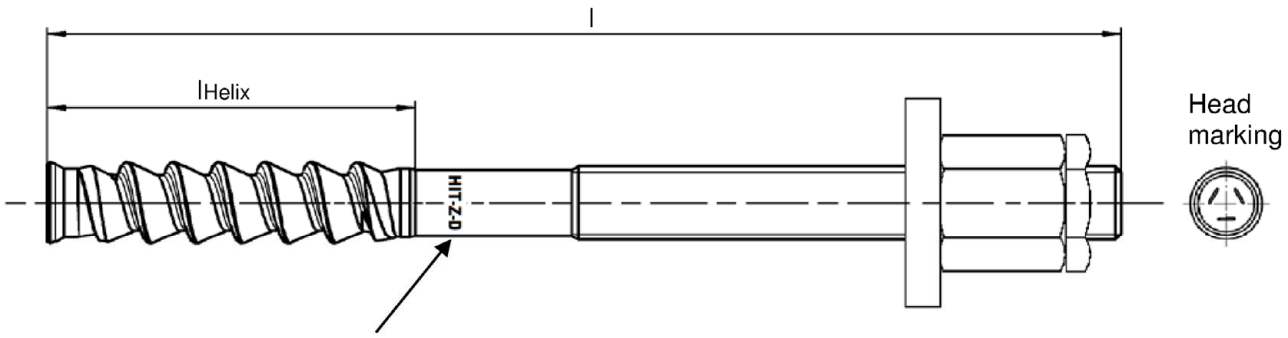
Table B1: Installation parameters HIT-Z(-R)-D TP

HIT-Z-D TP; HIT-Z-R-D TP				**M16**
Nominal diameter		d	[mm]	16
Nominal diameter of drill bit		d_0	[mm]	18
Length of fastener		min l	[mm]	175
		max l	[mm]	240
Length of helix		l_{Helix}	[mm]	96
Nominal anchorage depth		h_{ef}	[mm]	125
Drill hole condition ① Minimum thickness of concrete member		h_{min}	[mm]	225
Drill hole condition ② Minimum thickness of concrete member		h_{min}	[mm]	160
Maximum depth of drill hole		h_0	[mm]	$h - 2\ d_0$
Maximum diameter of clearance hole in the fixture		d_f	[mm]	20
Maximum fixture thickness		t_{fix}	[mm]	80
Installation torque moment	HIT-Z-D TP	T_{inst}	[Nm]	80
	HIT-Z-R-D TP	T_{inst}	[Nm]	155



Marking:
Embossing "HIT-Z-D M16 x l " zinc coated steel
Embossing "HIT-Z-R-D M16 x l“ stainless steel
(e.g. HIT-Z-D M16 x 175)

Hilti bonded expansion anchor HIT-Z-(R)-D TP	**Annex B2**
Intended use Installation parameters	

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Minimum edge distance and spacing

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

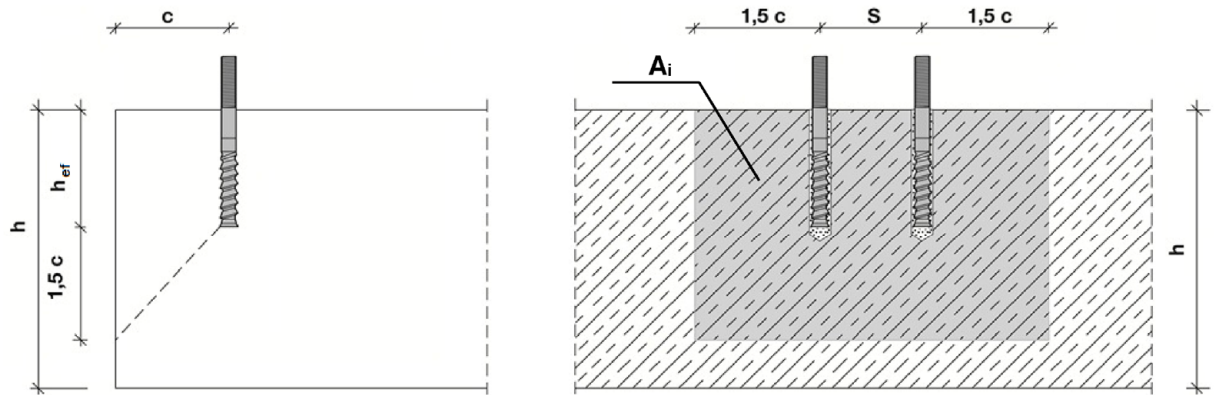
$$A_{i,req} < A_{i,ef}$$

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

HIT-Z-D TP; HIT-Z-R-D TP			M16
Cracked concrete	$A_{i,req}$	[mm²]	94700
Non-cracked concrete	$A_{i,req}$	[mm²]	128000

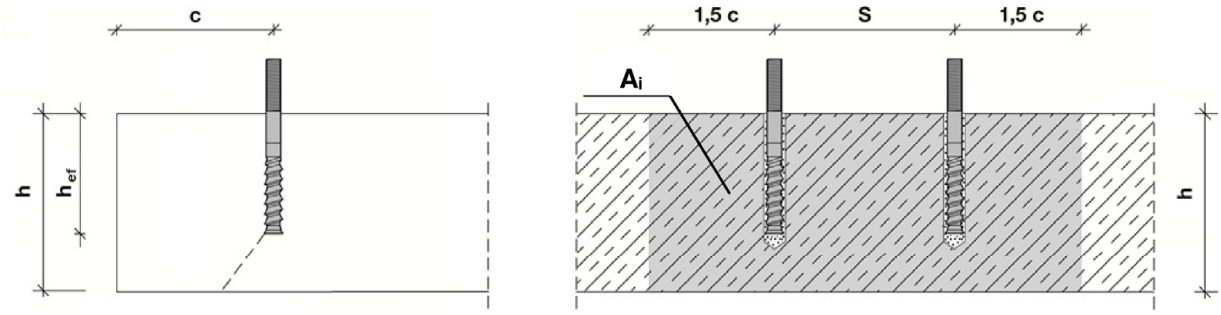
Table B3: Effective area $A_{i,ef}$

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



Single fastener and group of fasteners with $s > 3 \cdot c$	[mm²]	$A_{i,ef} = (6 \cdot c) \cdot (h_{ef} + 1{,}5 \cdot c)$	with $c \geq 5 \cdot d$
Group of fasteners with $s \leq 3 \cdot c$	[mm²]	$A_{i,ef} = (3 \cdot c + s) \cdot (h_{ef} + 1{,}5 \cdot c)$	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 $s > 3 \cdot c$	[mm²]	$A_{i,ef} = (6 \cdot c) \cdot h$	with $c \geq 5 \cdot d$
Group of fasteners with $s \leq 3 \cdot c$	[mm²]	$A_{i,ef} = (3 \cdot c + s) \cdot h$	with $c \geq 5 \cdot d$ and $s \geq 5 \cdot d$

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

Hilti bonded expansion anchor HIT-Z-(R)-D TP

Intended use
Installation parameters: member thickness, spacing and edge distances

Annex B3

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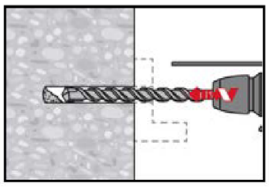
Table B4: Maximum working time and minimum curing time for HY200-A

Temperature in the base material T	Maximum working time t_{work}	Minimum curing time t_{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

Installation instructions

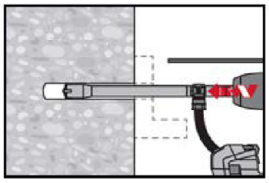
Hole drilling

a) Hammer drilling



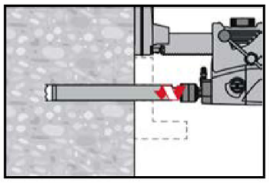
Through-setting: Drill hole through the clearance hole in the fixture to the required drilling depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.
Pre-setting: Drill hole to the required drilling depth with a hammer drill set in rotation-hammer mode using 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 - Borehole condition ②). After drilling is completed, proceed to the "injection preparation" step in the installation instruction.

c) Diamond coring

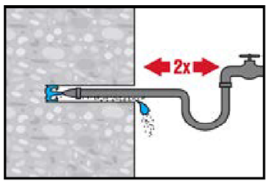


Diamond coring is permissible when suitable diamond core drilling machines and corresponding core bits are used.
Through-setting: Drill hole through the clearance hole in the fixture to the required drilling depth.
Pre-setting: Drill hole to the required embedment depth.

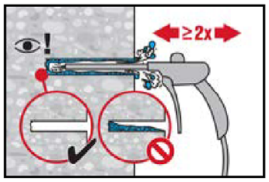
Bore hole cleaning

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.

Hilti bonded expansion anchor HIT-Z-(R)-D TP	Annex B4
Intended use Maximum working time and minimum curing time Installation instructions	

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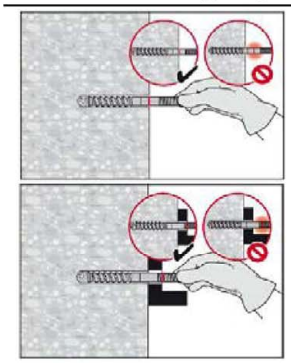
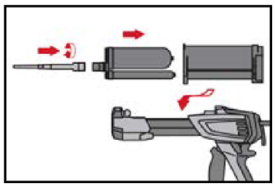
Check of setting depth

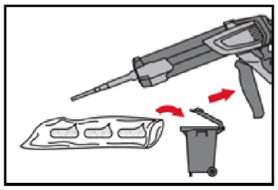


Mark the element and check the setting depth. The element has to fit in the hole until the required embedment depth. If it is not possible to insert the element to the required embedment depth, remove the dust in the drill hole or drill deeper.

Injection preparation



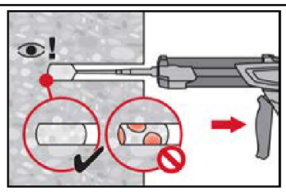
Tightly attach Hilti mixing nozzle HIT-RE-M to foil pack manifold. Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser and the mortar.
Check foil pack holder for proper function. Insert foil pack into foil pack holder and put holder into dispenser.



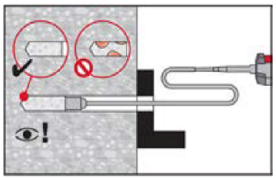
The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded. Discarded quantities are:

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

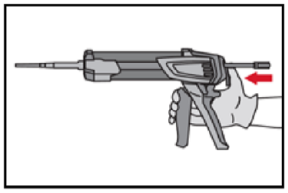
Inject adhesive from the back of the drill hole without forming air voids



Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull.
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 HIT-SZ 18. 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.

Hilti bonded expansion anchor HIT-Z-(R)-D TP	**Annex B5**
Intended use Installation instructions	

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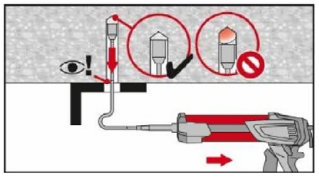
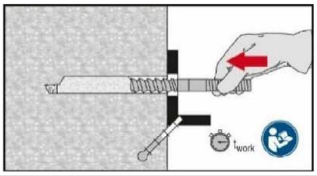
Overhead installation

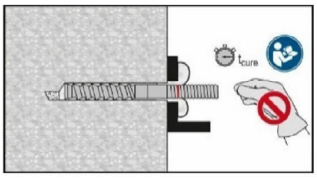


For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug HIT-SZ 18. Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure.

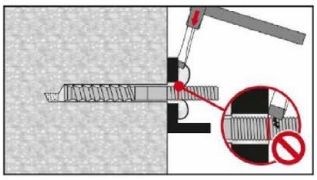
Setting the element



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.

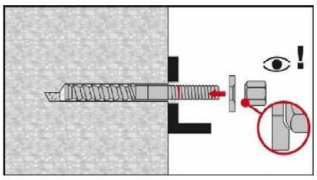


After required curing time t_{cure} (see Table B4) remove excess mortar.

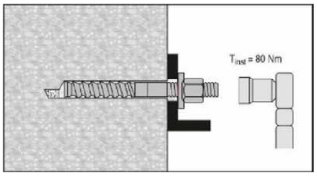


Do not damage thread of HIT-Z(-R)-D TP while removing excess mortar.

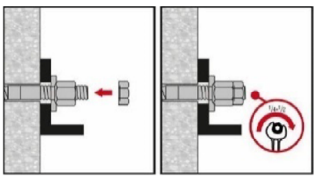
Final assembly with sealing washer



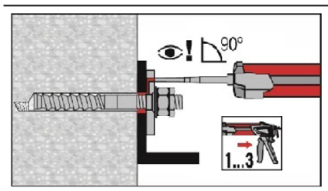
Orient the round part of the calotte nut to the sealing washer and install.



The required installation torque moment is given in Table B1.



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



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

Hilti bonded expansion anchor HIT-Z-(R)-D TP

Intended use
Installation instructions

Annex B6

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Table C1: Characteristic fatigue resistance under cycling tension loading in concrete (design method I acc. to TR 061)

Fastener				**HIT-Z-D TP M16**	**HIT-Z-R-D TP M16**
Steel failure					
Characteristic resistance			[kN]	$\Delta N_{Rk,s,0,n}$	
Number of cycles	n	1		96,0	96,0
		$\leq 10^3$		70,0	70,3
		$\leq 3 \cdot 10^3$		60,0	59,1
		$\leq 10^4$		48,9	46,4
		$\leq 3 \cdot 10^4$		39,7	35,7
		$\leq 10^5$		31,6	26,2
		$\leq 3 \cdot 10^5$		26,3	20,0
		$\leq 10^6$		22,5	15,9
		∞		18,8	12,4
Partial factor	$\gamma_{Ms,N,fat}$		[-]	acc. to TR 061, Eq. (3)	
Concrete failure					
Effective embedment depth	h_{ef}		[mm]	125	
Reduction factor[1)]			[-]	$\eta_{k,c,N,fat,n}$	
Number of cycles	n	1		1,00	
		$\leq 10^3$		0,75	
		$\leq 3 \cdot 10^3$		0,71	
		$\leq 10^4$		0,66	
		$\leq 3 \cdot 10^4$		0,62	
		$\leq 10^5$		0,58	
		$\leq 3 \cdot 10^5$		0,55	
		$\leq 10^6$		0,52	
		∞		0,50	
Partial factor	$\gamma_{Mc,fat}$		[-]	1,5	
Load transfer factor for fastener groups	ψ_{FN}		[-]	0,79	

[1)] $\Delta N_{Rk,(c,sp,cb),0,n} = \eta_{k,c,N,fat,n} \cdot N_{Rk,(c,sp,cb)}$ with $N_{Rk,(c,sp,cb)}$ according to ETA-15/0296.

Hilti bonded expansion anchor HIT-Z-(R)-D TP

Performances
Characteristic fatigue resistance under cycling tension loading in concrete (design method I acc. to TR 061)

Annex C1

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Table C2: Characteristic fatigue resistance under cycling shear loading in concrete (design method I acc. to TR 061)

Fastener				**HIT-Z-D TP M16**	**HIT-Z-R-D TP M16**
Steel failure					
Characteristic resistance			[kN]	$\Delta V_{Rk,s,0,n}$	
Number of cycles	n	1		48,0	57,0
		$\leq 10^3$		34,3	35,5
		$\leq 3 \cdot 10^3$		28,9	28,7
		$\leq 10^4$		23,0	21,9
		$\leq 3 \cdot 10^4$		18,3	16,8
		$\leq 10^5$		14,1	12,9
		$\leq 3 \cdot 10^5$		11,4	10,5
		$\leq 10^6$		9,6	9,1
		∞		8,0	8,0
Partial factor	$\gamma_{Ms,V,fat}$		[-]	acc. to TR 061, Eq. (3)	
Concrete failure					
Effective length of fastener	l_f		[mm]	125	
Effective outside diameter of fastener	d_{nom}		[mm]	18	
Reduction factor[1)]			[-]	$\eta_{k,c,V,fat,n}$	
Number of cycles	n	1		1,00	
		$\leq 10^3$		0,69	
		$\leq 3 \cdot 10^3$		0,63	
		$\leq 10^4$		0,57	
		$\leq 3 \cdot 10^4$		0,53	
		$\leq 10^5$		0,50	
		$\leq 3 \cdot 10^5$		0,50	
		$\leq 10^6$		0,50	
		∞		0,50	
Partial factor	$\gamma_{Mc,fat}$		[-]	1,5	
Load transfer factor for fastener groups	ψ_{FV}		[-]	0,75	

[1)] $\Delta V_{Rk,(c,cp),0,n} = \eta_{k,c,V,fat,n} \cdot V_{Rk,(c,cp)}$ with $V_{Rk,(c,cp)}$ according to ETA-15/0296.

Hilti bonded expansion anchor HIT-Z-(R)-D TP	**Annex C2**
Performances Characteristic fatigue resistance under cycling shear loading in concrete (design method I acc. to TR 061)	

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Table C3: Characteristic fatigue resistance under cycling tension loading in concrete (design method II acc. to TR 061)

Fastener			**HIT-Z-D TP M16**	**HIT-Z-R-D TP M16**
Steel failure				
Characteristic resistance	$\Delta N_{Rk,s,0,\infty}$	[kN]	18,8	12,4
Partial factor	$\gamma_{Ms,N,fat}$	[-]	1,35	
Concrete failure				
Effective embedment depth	h_{ef}	[mm]	125	
Reduction factor[1)]	$\eta_{k,c,N,fat,\infty}$	[-]	0,50	
Partial factor	$\gamma_{Mc,fat}$	[-]	1,5	
Load transfer factor for fastener groups	ψ_{FN}	[-]	0,79	

[1)] $\Delta N_{Rk,(c,sp,cb),0,n} = \eta_{k,c,N,fat,n} \cdot N_{Rk,(c,sp,cb)}$ with $N_{Rk,(c,sp,cb)}$ according to ETA-15/0296.

Table C4: Characteristic fatigue resistance under cycling shear loading in concrete (design method II acc. to TR 061)

Fastener			**HIT-Z-D TP M16**	**HIT-Z-R-D TP M16**
Steel failure				
Characteristic resistance	$\Delta V_{Rk,s,0,\infty}$	[kN]	8,0	8,0
Partial factor	$\gamma_{Ms,V,fat}$	[-]	1,35	
Concrete failure				
Effective length of fastener	l_f	[mm]	125	
Effective outside diameter of fastener	d_{nom}	[mm]	18	
Reduction factor[1)]	$\eta_{k,c,V,fat,\infty}$	[-]	0,50	
Partial factor	$\gamma_{Mc,fat}$	[-]	1,5	
Load transfer factor for fastener groups	ψ_{FV}	[-]	0,75	

[1)] $\Delta V_{Rk,(c,cp),0,\infty} = \eta_{k,c,V,fat,\infty} \cdot V_{Rk,(c,cp)}$ with $V_{Rk,(c,cp)}$ according to ETA-15/0296.

Hilti bonded expansion anchor HIT-Z-(R)-D TP

Performances
Characteristic fatigue resistance under cycling tension and shear loading in concrete (design method II acc. to TR 061)

Annex C3

Deutsches Institut für Bautechnik DIBt

Table C5: Characteristic fatigue resistance under cyclic combined tension and shear loading in concrete (design method I and II acc. to TR 061)

Fastener			**HIT-Z-D TP M16**	**HIT-Z-R-D TP M16**
Steel failure				
Exponent for combined fatigue load		[-]	α_{sn}	
Number of cycles	n	1	2,00	2,00
		$\leq 10^3$	1,42	1,27
		$\leq 3 \cdot 10^3$	1,41	1,19
		$\leq 10^4$	1,40	1,13
		$\leq 3 \cdot 10^4$	1,40	1,11
		$\leq 10^5$	1,40	1,10
		$\leq 3 \cdot 10^5$	1,40	1,10
		$\leq 10^6$	1,40	1,10
		∞	1,40	1,10
Concrete failure				
Exponent for combined fatigue load		[-]	α_c	
Number of cycles	n	≥ 1	1,5	