Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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European Technical Assessment ETA-17/0315 of 14 December 2017

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 170 with HIT-CS-F
Product family to which the construction product belongs	Torque controlled bonded anchor for use in concrete
Manufacturer	Hilti AG Feldkircherstraße 100 9494 Schaan FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	
This European Technical Assessment contains	15 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	ETAG 001 Part 5: "Bonded anchors", April 2013, used as EAD according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011.

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Specific Part

1 Technical description of the product

The injection system Hilti HIT-HY 170 with HIT-CS-F is a torque controlled bonded anchor for use in concrete consisting of a foil pack with injection mortar Hilti HIT-HY 170 and a conical rod (including two nuts and a washer) in the sizes of M16 and M20. The conical rod HIT-CS-F (including nuts and washer) is made of hot dip galvanized steel. The conical 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 action, displacements	See Annex C1 – C3
Characteristic resistance for seismic performance category C1 and C2, displacements	See Annex C4

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	No performance assessed

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances there may be requirements (e.g. transposed European legislation and national laws, regulations and administrative provisions) applicable to the products falling within the scope of this European Technical Assessment. In order to meet the provisions of Regulation (EU) No 305/2011, these requirements need also to be complied with, when and where they apply.

3.4 Safety in use (BWR 4)

The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

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

In accordance with guideline for European technical approval ETAG 001, April 2013 used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 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 EAD

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 14 December 2017 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

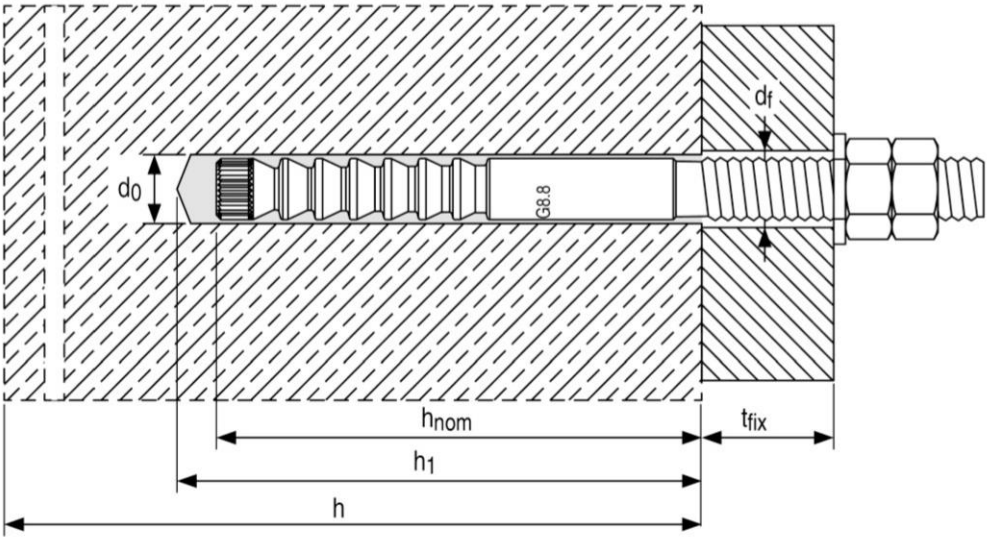
beglaubigt:
Lange

Deutsches Institut für Bautechnik

Installed condition

Figure A1:

Conical rod HIT-CS-F



Injection system Hilti HIT-HY 170 with HIT-CS-F	Annex A1
Product description Installed condition	

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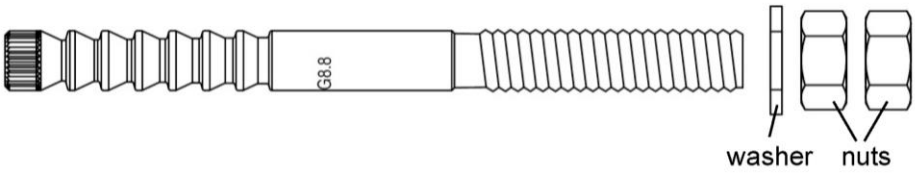
Product description: Injection mortar and steel elements

Injection mortar Hilti HIT-HY 170: Hybrid system with aggregate
330 ml and 500 ml

Static mixer Hilti HIT-RE-M

Steel elements



Hilti anchor rod HIT-CS-F with washer and 2 nuts
Thread sizes M16, M20

Table A1: Materials

Designation	Material
Steel elements made of hot dip galvanized steel	
Anchor rod HIT-CS-F-8.8	Strength class 8.8: f_{uk} = 800 N/mm², f_{yk} = 640 N/mm² Rupture elongation (l_0=5d) > 12% ductile Hot dip galvanized (F) ≥ 55 µm
Washer	Hot dip galvanized (F) ≥ 55 µm or ≥ 80 µm
Nut	Strength class of nut adapted to strength class of threaded rod Hot dip galvanized (F) ≥ 55 µm

Injection system Hilti HIT-HY 170 with HIT-CS-F	Annex A2
Product description Injection mortar / Static mixer / Steel elements / Materials	

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Specifications of intended use

Anchorages subject to:

- Static and quasi static loading.
- Seismic performance category C1 and C2.

Base material:

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000.
- Strength classes C20/25 to C50/60 according to EN 206-1:2000.
- Cracked or non-cracked concrete.

Temperature in the base material:

- **At installation**

  -5 °C to +40 °C
- **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)

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (hot dip galvanized steel).

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 static or quasi-static loading are designed in accordance with:
  - ETAG 001, Annex C, Design method A, Edition August 2010 or
  - CEN/TS 1992-4:2009, Design method A.
- Anchorages under seismic actions (cracked concrete) are designed in accordance with:
  - EOTA Technical Report TR 045, 02/2013.
  - Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure.
  - Fastenings in stand-off installation or with a grout layer under seismic action are not covered in this European Technical Assessment (ETA).

Installation:

- Use category: Dry or wet concrete (not in flooded holes).
- Drilling technique: Hammer drilling.
- Overhead installation is admissible.
- Anchor installation shall be carried out by appropriately qualified personnel under the supervision of the person responsible for technical matters of the site.

Injection system Hilti HIT-HY 170 with HIT-CS-F	Annex B1
Intended Use Specifications	

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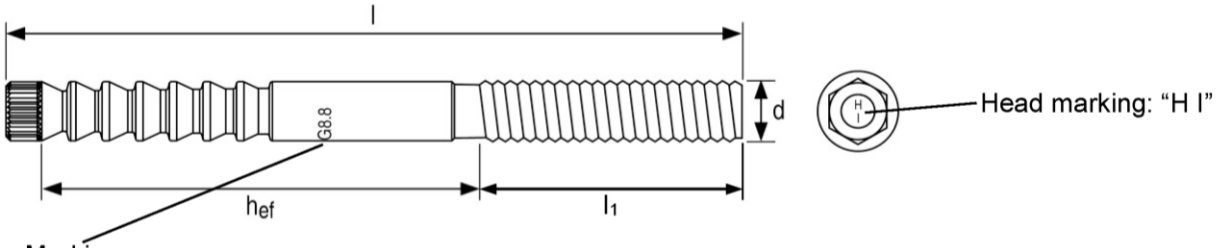
Table B1: Installation parameters HIT-CS-F

HIT-HY 170 with HIT-CS-F	Size		M16	M20
Nominal diameter	d	[mm]	16	20
Nominal diameter of drill bit	d_0	[mm]	18	24
Length of anchor	min l	[mm]	190	240
	max l	[mm]	675	720
Effective anchorage depth	h_{ef}	[mm]	117	158
Nominal embedment depth	h_{nom}	[mm]	125	170
Depth of drill hole	h_1	[mm]	130	175
Maximum diameter of clearance hole in the fixture [1)]	d_f	[mm]	18	22
Maximum fixture thickness	t_{fix}	[mm]	506	496
Minimum thickness of concrete member	h_{min}	[mm]	170	230
Minimum spacing and edge distance	s_{min}	[mm]	96	120
	for c ≥	[mm]	220	120
Minimum edge distance and spacing	c_{min}	[mm]	96	120
	for s ≥	[mm]	350	120
Installation torque	T_{inst}	[Nm]	80	150

[1)] For larger clearance hole see ETAG 001, Annex C, Section 4.2.2 or CEN/TS 1992-4-1, Section 5.2.3.1



Marking:
Embossing: "M..xh_{nom}/l_1 G8.8" hot dip galvanized steel (HIT CS-F)
(e.g. M16x125/85 G8.8)

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Table B2: Maximum working time and minimum curing time [1)]

Temperature in the base material T	Maximum working time t_{work}	Minimum curing time [1)] t_{cure}
-5°C to 0°C	10 min	12 h
> 0°C to 5°C	10 min	5 h
> 5°C to 10°C	8 min	2,5 h
> 10°C to 20°C	5 min	1,5 h
> 20°C to 30°C	3 min	45 min
> 30°C to 40°C	2 min	30 min

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

Table B3: Parameters of drilling, cleaning and setting tools

Steel element	Drill and clean		Installation
Anchor rod HIT-CS-F	Drill bit	Brush	Piston plug
			
Size	d_0 [mm]	HIT-RB	HIT-SZ
M16	18	18	18
M20	24	24	24

Cleaning equipment

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

Injection system Hilti HIT-HY 170 with HIT-CS-F	Annex B3
Intended Use Maximum working time and minimum curing time Drilling, cleaning and setting tools	

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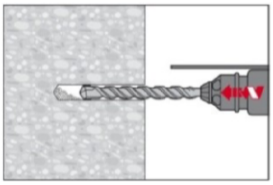
Installation instruction

Hole drilling

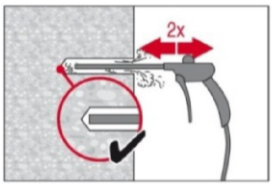
Hammer drilling



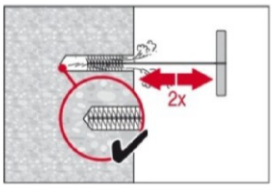
Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

Drill hole cleaning: Just before setting an anchor, the drill hole must be free of dust and debris.
Inadequate hole cleaning = poor load values.

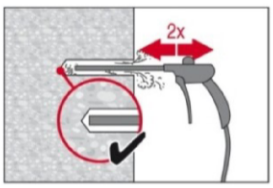
Compressed air cleaning (CAC): For all drill hole diameters d_0 and all drill hole depths h_1.



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

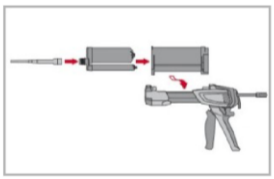


Brush 2 times with the specified brush (see Table B3) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush Ø ≧ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.

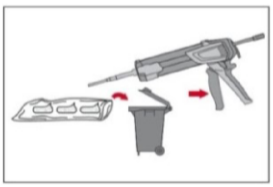


Blow again with compressed air 2 times until return air stream is free of noticeable dust.

Injection 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

Injection system Hilti HIT-HY 170 with HIT-CS-F

Intended Use
Installation instructions

Annex B4

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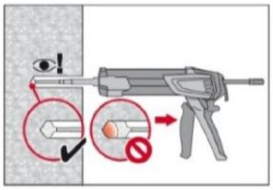
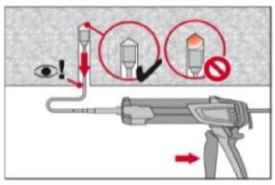
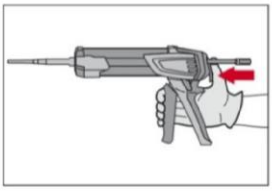
Inject adhesive from the back of the drill hole without forming air voids.



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

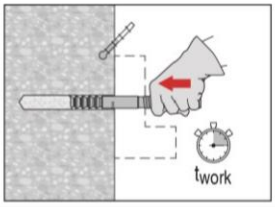


Overhead installation:
For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug HIT-SZ (see Table B3). Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure.

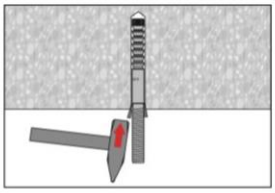


After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

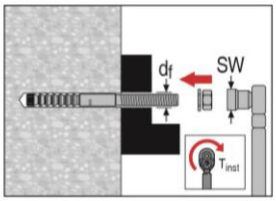
Setting the element



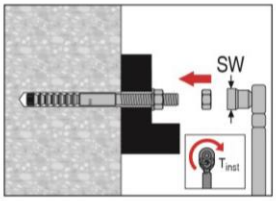
Before use, verify that the anchor rod is dry and free of oil and other contaminants.
Set the anchor rod to the required embedment depth before working time t_{work} has elapsed. The working time t_{work} is given in Table B2.



Overhead installation:
For overhead installation use piston plugs and fix embedded parts, e.g. with wedges (HIT-OHW).



After required curing time t_{cure} (see Table B2) remove excess mortar.
Assemble the washer and the first nut and apply the installation torque. The required installation torque T_{inst} is given in Table B1.



Assemble the second nut and apply the installation torque. The required installation torque T_{inst} is given in Table B1.
After torquing the anchor can be loaded.

Injection system Hilti HIT-HY 170 with HIT-CS-F	Annex B5
Intended Use Installation instructions	

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Table C1: Characteristic resistance for HIT-CS-F under tension load for static and quasi static loading

		Size		M16	M20
Installation safety factor		γ_2[1] = γ_{inst}[2]	[-]	1,0	
Steel failure					
Characteristic resistance		$N_{Rk,s}$	[kN]	125,6	190,2
Partial safety factor		$\gamma_{Ms,N}$	[-]	1,5	
Pull-out failure					
Characteristic resistance in uncracked concrete C20/25					
Temperature range I:	40 °C / 24 °C	$N_{Rk,p}$	[kN]	-[3]	-[3]
Temperature range II:	80 °C / 50 °C	$N_{Rk,p}$	[kN]	78,0	-[3]
Increasing factor for concrete strength class where $N_{Rk,p}$ is decisive.		ψ_c	C30/37	1,10	-[3]
			C40/50	1,18	-[3]
			C50/60	1,23	-[3]
Characteristic resistance in cracked concrete C20/25					
Temperature range I:	40 °C / 24 °C	$N_{Rk,p}$	[kN]	-[3]	-[3]
Temperature range II:	80 °C / 50 °C	$N_{Rk,p}$	[kN]	-[3]	-[3]
Concrete cone failure					
Effective embedment depth for calculation of $N_{Rk,c}$ (ETAG 001, Annex C, 5.2.2.4 or CEN/TS 1992-4:2009 part 4, 6.2.1.4)		h_{ef}	[mm]	117	158
Factor according to section 6.2.1.4 of CEN/TS 1992-4:2009 part 4		k_{ucr}[2]	[-]	10,1	
		k_{cr}[2]	[-]	7,2	
Edge distance		$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$	
Spacing		$s_{cr,N}$	[mm]	$3,0 \cdot h_{ef}$	
Splitting failure					
Effective embedment depth for calculation of $N_{Rk,sp}$ (ETAG 001, Annex C, 5.2.2.6 or CEN/TS 1992-4:2009 part 4, 6.2.1.5)		h_{ef}	[mm]	117	158
Factor according to section 6.2.1.4 of CEN/TS 1992-4:2009 part 4		k_{ucr}[2]	[-]	10,1	
		k_{cr}[2]	[-]	7,2	
Edge distance		$c_{cr,sp}$	[mm]	$2,6 \cdot h_{ef}$	
Spacing		$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$	

[1] Parameter for design according to ETAG 001, Annex C.
[2] Parameter for design according to CEN/TS 1992-4:2009.
[3] Pull-out failure not decisive.

Injection system Hilti HIT-HY 170 with HIT-CS-F

Performances
Characteristic resistance under tension load for static and quasi-static loading
Design according to ETAG 001, Annex C" or "CEN/TS 1992-4:2009

Annex C1

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Table C2: Characteristic resistance for HIT-CS-F under shear load for static and quasi static loading

	Size		M16	M20
Installation safety factor	γ_2 [1] = γ_{inst} [2]	[-]	1,0	
Steel failure without lever arm				
Factor according to section 6.2.2.2 of CEN/TS 1992-4:2009 part 4	k_2 [2]	[-]	1,0	
Characteristic resistance HIT-CS-F	$V_{Rk,s}$	[kN]	62,8	98,0
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,25	
Steel failure with lever arm				
Characteristic resistance HIT-CS-F	$M^0_{Rk,s}$	[Nm]	266	519
Partial safety factor	$\gamma_{Ms,V}$	[-]	1,25	
Concrete pry-out failure				
Factor acc. to equation (5.6) of ETAG 001, Annex C or acc. to equation (16) of CEN/TS 1992-4:2009 part 4	k [1] = k_3 [2]	[-]	2,0	
Concrete edge failure				
Effective length of anchor in shear loading	l_f	[mm]	h_{ef}	
Diameter of anchor	d [1] = d_{nom} [2]	[mm]	16	20

[1] Parameter for design according to ETAG 001, Annex C.
[2] Parameter for design according to CEN/TS 1992-4:2009.

Injection system Hilti HIT-HY 170 with HIT-CS-F

Performances
Characteristic resistance under shear load for static and quasi-static loading
Design according to ETAG 001, Annex C or CEN/TS 1992-4:2009

Annex C2

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Table C3: Displacements under tension load for HIT-CS-F for static and quasi static loading [1)]

Size			M16	M20
Non-cracked concrete				
Temperature range I: 40 °C / 24 °C				
Displacement	δ_{N0}-factor	[mm/kN]	0,006	0,006
Displacement	$\delta_{N\infty}$-factor	[mm/kN]	0,029	0,029
Temperature range II: 80 °C / 50 °C				
Displacement	δ_{N0}-factor	[mm/kN]	0,021	0,021
Displacement	$\delta_{N\infty}$-factor	[mm/kN]	0,040	0,040
Cracked concrete				
Temperature range I: 40 °C / 24 °C				
Displacement	δ_{N0}-factor	[mm/kN]	0,020	0,020
Displacement	$\delta_{N\infty}$-factor	[mm/kN]	0,029	0,029
Temperature range II: 80 °C / 50 °C				
Displacement	δ_{N0}-factor	[mm/kN]	0,035	0,035
Displacement	$\delta_{N\infty}$-factor	[mm/kN]	0,040	0,040

[1)] Calculation of the displacement:
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot N$; $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot N$; (N: applied tension load in [kN]).

Table C4: Displacements under shear load for HIT-CS-F for static and quasi static loading [1)]

Size			M16	M20
Displacement	δ_{V0}-factor	[mm/kN]	0,040	0,030
Displacement	$\delta_{V\infty}$-factor	[mm/kN]	0,060	0,045

[1)] Calculation of the displacement:
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; $\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$; (V: applied shear load in [kN])

Injection system Hilti HIT-HY 170 with HIT-CS-F	Annex C3
Performances Displacements for static and quasi-static loading	

Deutsches Institut für Bautechnik DIBt

Table C5: Characteristic resistance for HIT-CS-F under tension load for seismic performance categories C1 and C2

		Size		M16	M20
Installation safety factor		γ_2	[-]	1,0	
Steel failure					
Characteristic resistance HIT-CS-F		$N_{Rk,s,seis}$	[kN]	125,6	190,2
Pull-out failure					
Characteristic resistance (only C20/25)					
Temperature range I:	40 °C / 24 °C	$N_{Rk,p,seis}$	[kN]	43,1	71,5
Temperature range II:	80 °C / 50 °C	$N_{Rk,p,seis}$	[kN]	43,1	71,5

Table C6: Characteristic resistance for HIT-CS-F under shear load for seismic performance categories C1 and C2

	Size		M16	M20
Steel failure				
Characteristic resistance HIT-CS-F	$V_{Rk,s,seis}$	[kN]	31,6	51,9

Table C7: Displacements for HIT-CS-F under tension load for seismic performance category C2

	Size		M16	M20
Displacement DLS	$\delta_{N,seis(DLS)}$	[mm]	1,2	1,5
Displacement ULS	$\delta_{N,seis(ULS)}$	[mm]	2,7	2,6

Table C8: Displacements for HIT-CS-F under shear load for seismic performance category C2

	Size		M16	M20
Displacement DLS	$\delta_{V,seis(DLS)}$	[mm]	3,0	3,3
Displacement ULS	$\delta_{V,seis(ULS)}$	[mm]	4,6	5,3

Injection system Hilti HIT-HY 170 with HIT-CS-F	Annex C4
Performances Characteristic resistances and displacements for seismic performance categories C1 + C2 Design according to EOTA Technical Report TR 045, 02/2013	