Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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-14/0457 of 10 March 2015

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 |
| Product family to which the construction product belongs | Bonded anchor for use in concrete |
| Manufacturer | Hilti Aktiengesellschaft<br>9494 SCHAAN<br>FÜRSTENTUM LIECHTENSTEIN |
| Manufacturing plant | Hilti Werke |
| This European Technical Assessment contains | 18 pages including 3 annexes |
| This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of | Guideline for European technical approval of "Metal anchors for use in concrete", ETAG 001 Part 5: "Bonded anchors", April 2013,<br>used as European Assessment Document (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 is a bonded anchor consisting of a foil pack with injection mortar Hilti HIT-HY 170 and a steel element. The steel element consist of a threaded rod HIT-V or a commercial threaded rod with washer and hexagon nut in the range of M8 to M24 or an internal threaded sleeve in the range of M8 to M16.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, 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 for design according to TR 029 | See Annex C1 to C3 |
| Displacements under tension and shear loads | 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 determined (NPD) |

### 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.

### 3.5 Protection against noise (BWR 5)

Not applicable.

### 3.6 Energy economy and heat retention (BWR 6)

Not applicable.

### 3.7 Sustainable use of natural resources (BWR 7)

The sustainable use of natural resources was not investigated.

### 3.8 General aspects

The verification of durability is part of testing the essential characteristics. Durability is only ensured if the specifications of intended use according to Annex B are taken into account.

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

According to Decision of the Commission of 24 June 1996 (96/582/EC) (OJ L 254 of 08.10.96 p. 62-65), the system of assessment and verification of constancy of performance (see Annex V and Article 65 Paragraph 2 to Regulation (EU) No 305/2011) given in the following table applies.

| Product | Intended use | Level or class | System |
|---|---|---|---|
| Metal anchors for use in concrete (heavy-duty type) | For fixing and/or supporting concrete structural elements or heavy units such as cladding and suspended ceilings | — | 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 10 March 2015 by Deutsches Institut für Bautechnik

Uwe Bender
Head of Department

*beglaubigt:*
Lange

Deutsches Institut für Bautechnik DIBt

## Installed condition

**Figure A1:**
**Threaded rod and HIT-V-...**

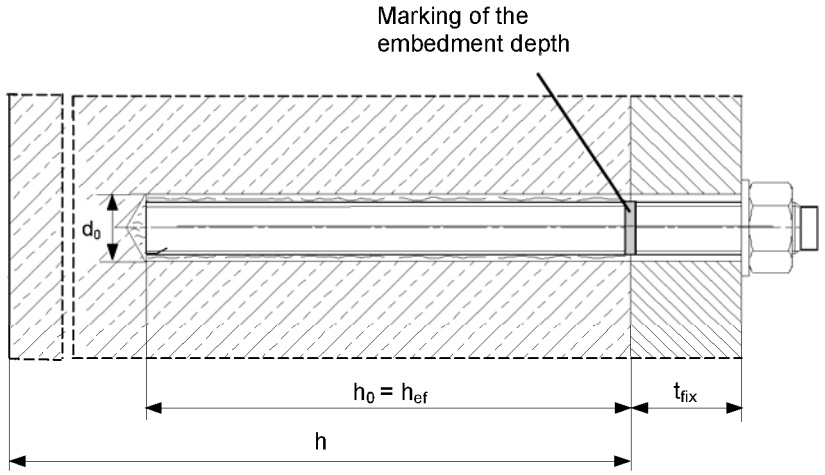
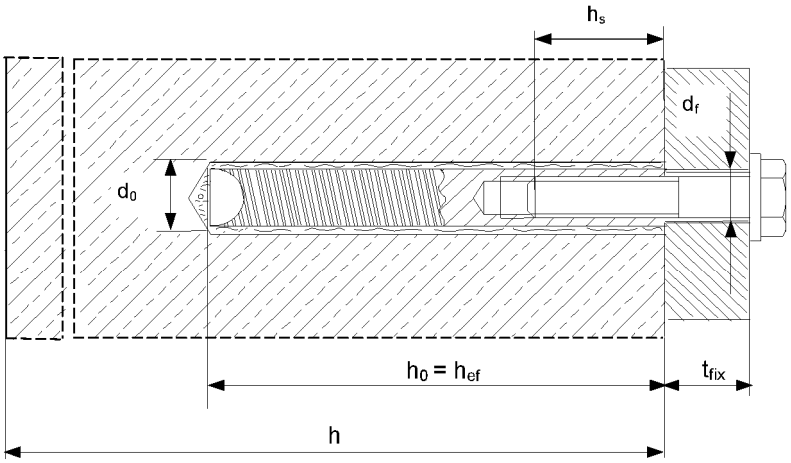



**Figure A2:**
**Internally threaded sleeve HIS-(R)N**






| Injection system Hilti HIT-HY 170 | |
|---|---|
| **Product description**<br>Installed condition | **Annex A1** |

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## Product description: Injection mortar and steel elements

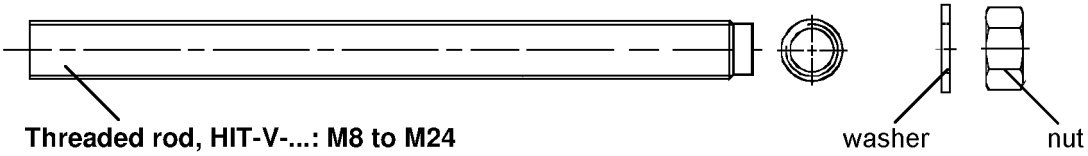
**Injection mortar Hilti HIT-HY 170:** hybrid system with aggregate
**330 ml and 500 ml**

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


Product name: "Hilti HIT-HY 170"

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

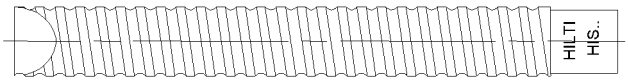
**Steel elements**



**Threaded rod, HIT-V-...: M8 to M24** washer nut

Commercial standard threaded rod with:

- Materials and mechanical properties according to Table A1
- Inspection certificate 3.1 according to EN 10204: 2004. The document shall be stored.
- Marking of embedment depth




**Internally threaded sleeve: HIS-(R)N M8 to M16**



| **Injection system Hilti HIT-HY 170** | |
|---|---|
| **Product description**<br>Injection mortar / Static mixer / Steel elements | **Annex A2** |

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## Table A1: Materials

| Designation | Material |
|---|---|
| **Metal parts made of zinc coated steel** | |
| Threaded rod HIT-V-5.8(F) | Strength class 5.8, $f_{uk}$ = 500 N/mm²; $f_{yk}$ = 400 N/mm²<br>Elongation at fracture ($l_0$=5d) > 8% ductile<br>Electroplated zinc coated ≥ 5 µm<br>(F) Hot dip galvanized ≥ 45 µm |
| Threaded rod HIT-V-8.8(F) | Strength class 8.8 , $f_{uk}$ = 800 N/mm², $f_{yk}$ = 640 N/mm²<br>Elongation at fracture ($l_0$=5d) > 8% ductile<br>Electroplated zinc coated ≥ 5 µm<br>(F) Hot dip galvanized ≥ 45 µm |
| Internally threaded sleeve HIS-N | Electroplated zinc coated ≥ 5µm |
| Washer | Electroplated zinc coated ≥ 5 µm<br>Hot dip galvanized ≥ 45 µm |
| Nut | Strength class of nut adapted to strength class of threaded rod<br>Electroplated zinc coated ≥ 5 µm<br>Hot dip galvanized ≥ 45 µm |
| **Metal parts made of stainless steel** | |
| Threaded rod HIT-V-R | Strength class 70, $f_{uk}$ = 700 N/mm², $f_{yk}$ = 450 N/mm²<br>Elongation at fracture ($l_0$=5d) > 8% ductile<br>Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014 |
| Internally threaded sleeve HIS-RN | Stainless steel 1.4401, 1.4571 EN 10088-1:2014 |
| Washer | Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014 |
| Nut | Strength class of nut adapted to strength class of threaded rod<br>Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 EN 10088-1:2014 |
| **Metal parts made of high corrosion resistant steel** | |
| Threaded rod HIT-V-HCR | For ≤ M20: $f_{uk}$ = 800 N/mm², $f_{yk}$ = 640 N/mm²<br>Elongation at fracture ($l_0$=5d) > 8% ductile<br>For > M20: $f_{uk}$ = 700 N/mm², $f_{yk}$ = 400 N/mm²<br>Elongation at fracture ($l_0$=5d) > 8% ductile<br>High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014 |
| Washer | High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014 |
| Nut | Strength class of nut adapted to strength class of threaded rod<br>High corrosion resistant steel 1.4529, 1.4565 EN 10088-1:2014 |



**Injection system Hilti HIT-HY 170**

**Product description**
Materials

**Annex A3**

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## Specifications of intended use

**Anchorages subject to:**

- Static and quasi static loading: M8 to M24

**Base material:**

- Reinforced or unreinforced normal weight concrete according to EN 206:2013.
- Strength classes C20/25 to C50/60 according to EN 206:2013.
- Cracked and non-cracked concrete according to Table B1.

## Table B1: Specifications of intended use

| **Anchorages subject to:** | | **HIT-HY 170 with …** | |
|---|---|---|---|
| Elements | | Threaded rod, HIT-V-…  | HIS-(R)N  |
| Hammer drilling mode  | | ✓ | ✓ |
| Static and quasi static loading in non-cracked concrete | | M8 to M24<br>Table : C1, C2, C5, C6 | M8 to M16<br>Table : C3, C4, C7, C8 |
| Static and quasi static loading in cracked concrete | | M10 to M16<br>Table : C1, C2, C5, C6 | - |
| Temperature in the base material at installation | | -5° C to +40° C | |
| In-service temperature | 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
  (zinc coated steel, stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal conditions, if no particular aggressive conditions exist
  (stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure and to permanently damp internal conditions, if other particular aggressive conditions exist
  (high corrosion resistant steel).
  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 products are used).

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**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: "EOTA Technical Report TR 029, Edition September 2010".

**Installation:**

- Use category: dry or wet concrete (not in flooded holes)
- Overhead installation is admissible
- Anchor 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 170** | **Annex B2** |
|---|---|
| **Intended Use**<br>Specifications | |

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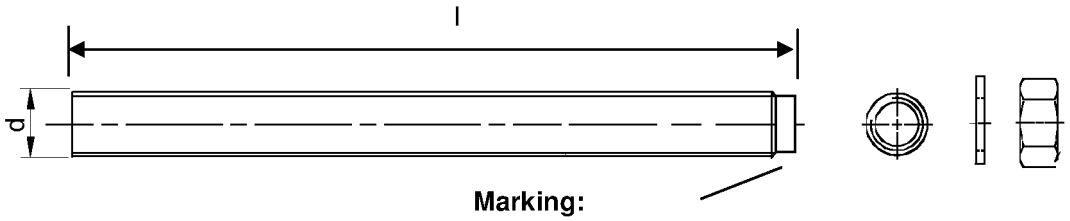
## Table B2: Installation parameters of threaded rod, HIT-V-…

| HIT-HY 170 with threaded rod, HIT-V-… | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| Diameter of element | d | [mm] | 8 | 10 | 12 | 16 | 20 | 24 |
| Nominal diameter of drill bit | $d_0$ | [mm] | 10 | 12 | 14 | 18 | 22 | 28 |
| Range of effective embedment depth and depth of drilled hole | $h_{ef} = h_0$ | [mm] | 60 to 96 | 60 to 120 | 70 to 144 | 80 to 192 | 90 to 240 | 96 to 288 |
| Maximum diameter of clearance hole in the fixture [1)] | $d_f$ | [mm] | 9 | 12 | 14 | 18 | 22 | 26 |
| Minimum thickness of concrete member | $h_{min}$ | [mm] | $h_{ef}$ + 30 mm ≥ 100 mm | | | $h_{ef} + 2 \cdot d_0$ | | |
| Maximum torque moment | $T_{max}$ | [Nm] | 10 | 20 | 40 | 80 | 150 | 200 |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 50 | 60 | 80 | 100 | 120 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 50 | 60 | 80 | 100 | 120 |

[1)] for larger clearance hole see “TR 029 section 1.1”

**HIT-V-…**




**Marking:**

5.8 - l = HIT-V-5.8 M…x l
5.8F - l = HIT-V-5.8F M…x l
8.8 - l = HIT-V-8.8 M…x l
8.8F - l = HIT-V-8.8F M…x l
R - l = HIT-V-R M …x l
HCR - l = HIT-V-HCR M …x l



| **Injection system Hilti HIT-HY 170** | **Annex B3** |
|---|---|
| **Intended Use**<br>Installation parameters | |

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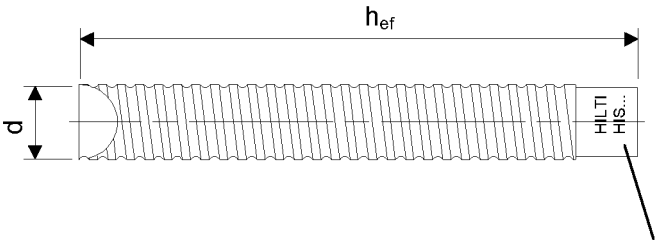
## Table B3: Installation parameters of internally threaded sleeve HIS-(R)N

| HIT-HY 170 with HIS-(R)N | | | M8 | M10 | M12 | M16 |
|---|---|---|---|---|---|---|
| Outer diameter of sleeve | d | [mm] | 12,5 | 16,5 | 20,5 | 25,4 |
| Nominal diameter of drill bit | $d_0$ | [mm] | 14 | 18 | 22 | 28 |
| Effective embedment depth and drill hole depth | $h_{ef} = h_0$ | [mm] | 90 | 110 | 125 | 170 |
| Maximum diameter of clearance hole in the fixture [1)] | $d_f$ | [mm] | 9 | 12 | 14 | 18 |
| Minimum thickness of concrete member | $h_{min}$ | [mm] | 120 | 150 | 170 | 230 |
| Maximum torque moment | $T_{max}$ | [Nm] | 10 | 20 | 40 | 80 |
| Thread engagement length min-max | $h_s$ | [mm] | 8-20 | 10-25 | 12-30 | 16-40 |
| Minimum spacing | $s_{min}$ | [mm] | 60 | 75 | 90 | 115 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 45 | 55 | 65 |

[1)] for larger clearance hole see “TR 029 section 1.1”

**Internally threaded sleeve HIS-(R)N…**




**Marking:**
Identifying mark - HILTI and
embossing "HIS-N" (for C-steel)
embossing "HIS-RN" (for stainless steel)



| **Injection system Hilti HIT-HY 170** | |
|---|---|
| **Intended Use**<br>Installation parameters | **Annex B4** |

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## Table B4: Maximum working time and minimum curing time [1)]

| Temperature in the base material T | Maximum working time $t_{work}$ | Maximum curing time $t_{cure}$ |
|---|---|---|
| -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 B5: Parameters of cleaning and setting tools

| Elements | | Drill and clean | | Installation |
|---|---|---|---|---|
| HIT-V-... | HIS-(R)N | Hammer drilling | Brush | Piston plug |
|  |  |  |  |  |
| size | size | $d_0$ [mm] | HIT-RB | HIT-SZ |
| M8 | - | 10 | 10 | - |
| M10 | - | 12 | 12 | 12 |
| M12 | M8 | 14 | 14 | 14 |
| M16 | M10 | 18 | 18 | 18 |
| M20 | M12 | 22 | 22 | 22 |
| M24 | M16 | 28 | 28 | 28 |

## Cleaning alternatives

**Manual Cleaning (MC):**
Hilti hand pump for blowing out drill holes with diameters $d_0 \leq 18$ mm and drill hole depths $h_0 \leq 10 \cdot d$

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



**Injection system Hilti HIT-HY 170**

**Intended Use**
Minimum working and curing time
Cleaning and setting tools

**Annex B5**

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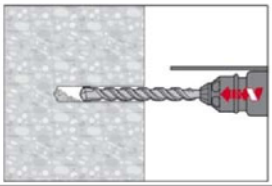
## Installation

### Hole drilling

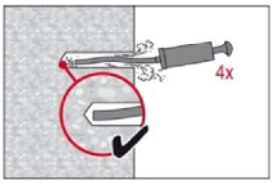
### Hammer drilling



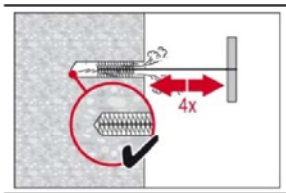
Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

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

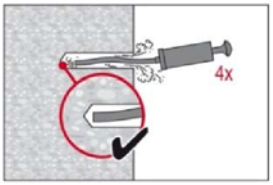
**Manual Cleaning (MC)** **Non-cracked concrete only**
for drill hole diameters $d_0 \leq 18$ mm and drill hole depths $h_0 \leq 10 \cdot d$




The Hilti manual pump may be used for blowing out drill holes up to diameters $d_0 \leq 18$ mm and embedment depths up to $h_{ef} \leq 10 \cdot d$.
Blow out at least 4 times from the back of the hole until return air stream is free of noticeable dust

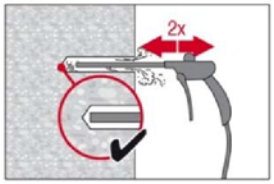



Brush 4 times with the specified brush (see Table B5) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.

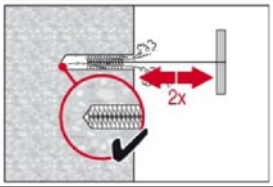



Blow out again with manual pump at least 4 times until return air stream is free of noticeable dust.

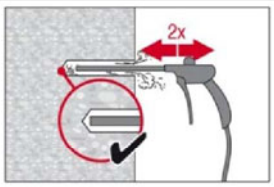
**Compressed air cleaning (CAC)** for all drill hole diameters $d_0$ and all drill hole depths $h_0$




Blow 2 times from the back of the hole (if needed with nozzle extension) over the 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 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 170**

**Intended Use**
Installation instructions

**Annex B6**

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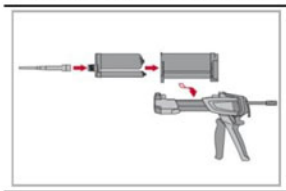
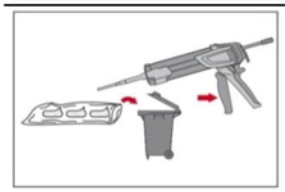
## Injection preparation



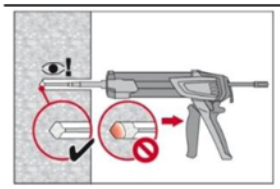
Tightly attach new Hilti mixing nozzle HIT-RE-M to foil pack manifold (snug fit). Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser.
Check foil pack holder for proper function. Do not use damaged foil packs / holders.
Insert foil pack into foil pack holder and put holder into HIT-dispenser.



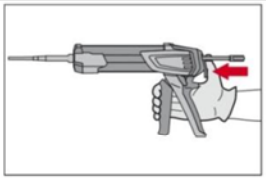
Discard initial adhesive. The foil pack opens automatically as dispensing is initiated.
Depending on the size of the foil pack an initial amount of adhesive has to be discarded.
Discarded quantities are

| | |
|---|---|
| 2 strokes | for 330 ml foil pack, |
| 3 strokes | for 500 ml foil pack |

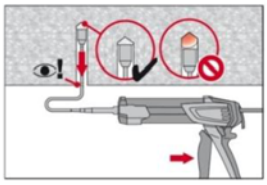
**Inject adhesive** from the back of the drill hole without forming air voids.



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

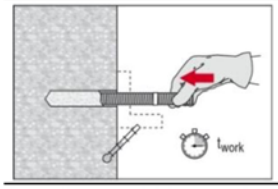


After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

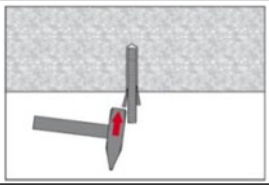


Overhead installation and/or installation with embedment depth $h_{ef}$ > 250mm.
For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug HIT-SZ (see Table B5). Insert piston plug to 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

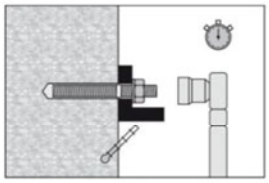
## Setting the element




Before use, verify that the element is dry and free of oil and other contaminants.
Mark and set element to the required embedment depth until working time $t_{work}$ has elapsed. The working time $t_{work}$ is given in Table B4



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



Loading the anchor: After required curing time $t_{cure}$ (see Table B4) the anchor can be loaded.
The applied installation torque shall not exceed the values $T_{max}$ given in Table B2 and Table B3.

| | |
|---|---|
| **Injection system Hilti HIT-HY 170** | |
| **Intended Use**<br>Installation instructions | **Annex B7** |

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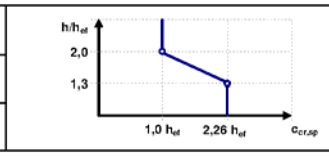
## Table C1: Characteristic values of resistance for threaded rod, HIT-V-… under tension loads in concrete

| HIT-HY 170 with threaded rod, HIT-V-… | | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|---|
| Installation safety factor | | $\gamma_2$ | [-] | 1,0 | | | | | |
| **Steel failure** | | | | | | | | | |
| Characteristic steel resistance | | $N_{Rk,s}$ | [kN] | $A_s \cdot f_{uk}$ | | | | | |
| **Combined pullout and concrete cone failure** | | | | | | | | | |
| Characteristic bond resistance in non-cracked concrete C20/25 | | | | | | | | | |
| Temperature range I: | 40 °C/24 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 10,0 | | | | | |
| Temperature range II: | 80 °C/50 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 7,5 | | | | | |
| Characteristic bond resistance in cracked concrete C20/25 | | | | | | | | | |
| Temperature range I: | 40 °C/24 °C | $\tau_{Rk,cr}$ | [N/mm²] | - | 5,5 | | | - | |
| Temperature range II: | 80 °C/50 °C | $\tau_{Rk,cr}$ | [N/mm²] | - | 4,0 | | | - | |
| Increasing factors for $\tau_{Rk}$ in concrete | | $\psi_c$ | C30/37 | 1,04 | | | | | |
| | | | C40/50 | 1,07 | | | | | |
| | | | C50/60 | 1,09 | | | | | |
| **Splitting failure** | | | | | | | | | |
| Edge distance $c_{cr,sp}$ [mm] for | $h / h_{ef} \geq 2,0$ | | | $1,0 \cdot h_{ef}$ |  | | | | |
| | $2,0 > h / h_{ef} > 1,3$ | | | $4,6\ h_{ef} - 1,8\ h$ | | | | | |
| | $h / h_{ef} \leq 1,3$ | | | $2,26\ h_{ef}$ | | | | | |
| Spacing | | $s_{cr,sp}$ | [mm] | $2 \cdot c_{cr,sp}$ | | | | | |



## Table C2: Characteristic values of resistance for threaded rod, HIT-V-… under shear loads in concrete

| HIT-HY 170 with threaded rod, HIT-V-… | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| **Steel failure without lever arm** | | | | | | | | |
| Characteristic steel resistance | $V_{Rk,s}$ | [kN] | $0,5 \cdot A_s \cdot f_{uk}$ | | | | | |
| **Steel failure with lever arm** | | | | | | | | |
| Characteristic bending moment | $M^0_{Rk,s}$ | [Nm] | $1,2 \cdot W_{el} \cdot f_{uk}$ | | | | | |
| **Concrete pry-out failure** | | | | | | | | |
| Factor in equation (5.7) of Technical Report TR 029 for the design of bonded anchors | k | [-] | 2,0 | | | | | |



**Injection system Hilti HIT-HY 170**

**Performances**
Characteristic values of resistance under tension and shear loads in concrete
Design according to „EOTA Technical Report TR 029, Edition September 2010“

**Annex C1**

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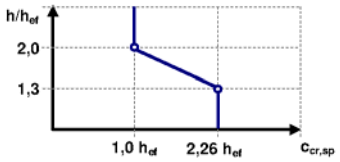
## Table C3: Characteristic values of resistance for internally threaded sleeve HIS-(R)N under tension loads in non-cracked concrete

| **HIT-HY 170 with HIS-(R)N** | | | | **M8** | **M10** | **M12** | **M16** |
|---|---|---|---|---|---|---|---|
| Installation safety factor | | $\gamma_2$ | [-] | 1,0 | | | |
| **Steel failure** | | | | | | | |
| HIS-N with screw grade 8.8 | | $N_{Rk,s}$ | [kN] | 25 | 46 | 67 | 125 |
| Partial safety factor | | $\gamma_{Ms,N}$ | [-] | 1,50 | | | |
| HIS-RN with screw grade 70 | | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 |
| Partial safety factor | | $\gamma_{Ms,N}$ | [-] | 1,87 | | | |
| **Combined pullout and concrete cone failure** | | | | | | | |
| Characteristic bond resistance in non-cracked concrete C20/25 | | | | | | | |
| Temperature range I: | 40 °C/24 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 10,0 | | | |
| Temperature range II: | 80 °C/50 °C | $\tau_{Rk,ucr}$ | [N/mm²] | 7,5 | | | |
| Increasing factors for $\tau_{Rk,ucr}$ in concrete | | $\psi_{c,ucr}$ | C30/37 | 1,04 | | | |
| | | | C40/50 | 1,07 | | | |
| | | | C50/60 | 1,09 | | | |
| **Splitting failure** | | | | | | | |
| Edge distance $c_{cr,sp}$ [mm] for | | $h / h_{ef} \geq 2,0$ | | $1,0 \cdot h_{ef}$ | | | |
| | | $2,0 > h / h_{ef} > 1,3$ | | $4,6\ h_{ef} - 1,8\ h$ | | | |
| | | $h / h_{ef} \leq 1,3$ | | $2,26\ h_{ef}$ | | | |
| Spacing | | $s_{cr,sp}$ | [mm] | $2 \cdot c_{cr,sp}$ | | | |



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## Table C4: Characteristic values of resistance for internally threaded sleeve HIS-(R)N under shear loads in non-cracked concrete

| HIT-HY 170 with HIS-(R)N | | | M8 | M10 | M12 | M16 |
|---|---|---|---|---|---|---|
| **Steel failure without lever arm** | | | | | | |
| HIS-N with screw grade 8.8 | $V_{Rk,s}$ | [kN] | 13 | 23 | 34 | 63 |
| Partial safety factor | $\gamma_{Ms,V}$ | [-] | 1,25 | | | |
| HIS-RN with screw grade 70 | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 |
| Partial safety factor | $\gamma_{Ms,V}$ | [-] | 1,56 | | | |
| **Steel failure with lever arm** | | | | | | |
| HIS-N with screw grade 8.8 | $M^0_{Rk,s}$ | [Nm] | 30 | 60 | 105 | 266 |
| Partial safety factor | $\gamma_{Ms,V}$ | [-] | 1,25 | | | |
| HIS-RN with screw grade 70 | $M^0_{Rk,s}$ | [Nm] | 26 | 52 | 92 | 233 |
| Partial safety factor | $\gamma_{Ms,V}$ | [-] | 1,56 | | | |
| **Concrete pry-out failure** | | | | | | |
| Factor in equation (5.7) of Technical Report TR 029 for the design of bonded anchors | k | [-] | 2,0 | | | |

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## Table C5: Displacement under tension load

| HIT-HY 170 with threaded rod, HIT-V-… | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| **Non-cracked concrete** | | | | | | | | |
| Displacement | $\delta_{N0}$ | [mm/(N/mm²)] | 0,07 | 0,07 | 0,07 | 0,08 | 0,08 | 0,09 |
| Displacement | $\delta_{N\infty}$ | [mm/(N/mm²)] | 0,07 | 0,07 | 0,07 | 0,08 | 0,08 | 0,09 |
| **Cracked concrete** | | | | | | | | |
| Displacement | $\delta_{N0}$ | [mm/(N/mm²)] | - | 0,07 | 0,07 | 0,06 | - | - |
| Displacement | $\delta_{N\infty}$ | [mm/(N/mm²)] | - | 0,11 | 0,11 | 0,11 | - | - |

## Table C6: Displacement under shear load

| HIT-HY 170 with threaded rod, HIT-V-… | | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|---|
| Displacement | $\delta_{V0}$ | [mm/(N/mm²)] | 0,06 | 0,06 | 0,05 | 0,04 | 0,04 | 0,03 |
| Displacement | $\delta_{V\infty}$ | [mm/(N/mm²)] | 0,09 | 0,08 | 0,08 | 0,06 | 0,06 | 0,05 |

## Table C7: Displacement under tension load

| HIT-HY 170 with HIS-(R)N | | | M8 | M10 | M12 | M16 |
|---|---|---|---|---|---|---|
| **Non-cracked concrete** | | | | | | |
| Displacement | $\delta_{N\infty}$ | [mm/(N/mm²)] | 0,06 | 0,07 | 0,08 | 0,09 |
| Displacement | $\delta_{N\infty}$ | [mm/(N/mm²)] | 0,06 | 0,07 | 0,08 | 0,09 |

## Table C8: Displacement under shear load

| HIT-HY 170 with HIS-(R)N | | | M8 | M10 | M12 | M16 |
|---|---|---|---|---|---|---|
| Displacement | $\delta_{V0}$ | [mm/(N/mm²)] | 0,10 | 0,10 | 0,10 | 0,10 |
| Displacement | $\delta_{V\infty}$ | [mm/(N/mm²)] | 0,15 | 0,15 | 0,15 | 0,15 |