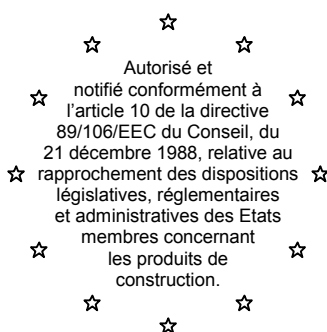


# Centre Scientifique et Technique du Bâtiment

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## European Technical Approval

## ETA-08/0352

(English language translation, the original version is in French language)

Nom commercial :

**Trade name:**

Titulaire :

**Holder of approval:**

Type générique et utilisation prévue du produit de construction :

**Generic type and use of construction product:**

Validité du :

au :

**Validity from / to:**

Usine de fabrication :

**Manufacturing plant:**

Le présent Agrément technique européen contient :

**This European Technical Approval contains:**

**Injection system Hilti HIT-HY 150 MAX**

**Hilti Corporation  
Feldkircherstrasse 100  
FL-9494 Schaan  
Principality of Liechtenstein**

Cheville à scellement de type "à injection" pour fixation dans le béton non fissuré M8 à M30.

**Bonded injection type anchor for use in non cracked concrete: sizes M8 to M30**

**18/12/2008**

**18/12/2013**

**Plan n°1**

28 pages incluant 18 annexes faisant partie intégrante du document.

**28 pages including 18 annexes which form an integral part of the document.**



Organisation pour l'Agrément Technique Européen  
European Organisation for Technical Approvals

## I LEGAL BASES AND GENERAL CONDITIONS

1. This European Technical Approval is issued by the Centre Scientifique et Technique du Bâtiment in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products<sup>1</sup>, modified by the Council Directive 93/68/EEC of 22 July 1993<sup>2</sup>;
- Décret n° 92-647 du 8 juillet 1992<sup>3</sup> concernant l'aptitude à l'usage des produits de construction;
- Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC<sup>4</sup>;
- Guideline for European Technical Approval of « Metal Anchors for use in Concrete » ETAG 001, edition 1997, Part 1 « Anchors in general » and Part 5 « Bonded anchors».

2. The Centre Scientifique et Technique du Bâtiment is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant (for example concerning the fulfilment of assumptions made in this European Technical Approval with regard to manufacturing). Nevertheless, the responsibility for the conformity of the products with the European Technical Approval and for their suitability for the intended use remains with the holder of the European Technical Approval.

3. This European Technical Approval is not to be transferred to manufacturers or agents of manufacturer other than those indicated on page 1; or manufacturing plants other than those indicated on page 1 of this European Technical Approval.

4. This European Technical Approval may be withdrawn by the Centre Scientifique et Technique du Bâtiment pursuant to Article 5 (1) of the Council Directive 89/106/EEC.

5. Reproduction of this European Technical Approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of the Centre Scientifique et Technique du Bâtiment. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.

6. The European Technical Approval is issued by the approval body in its official language. This version corresponds to the version circulated within EOTA. Translations into other languages have to be designated as such.

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1 Official Journal of the European Communities n° L 40, 11.2.1989, p. 12

2 Official Journal of the European Communities n° L 220, 30.8.1993, p. 1

3 Journal officiel de la République française du 14 juillet 1992

4 Official Journal of the European Communities n° L 17, 20.1.1994, p. 34

## II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

### 1 Definition of product and intended use

#### 1.1. Definition of product

The injection system Hilti HIT-HY 150 MAX is a bonded anchor system (injection type) consisting of a foil pack with injection mortar Hilti HIT-HY 150 MAX and a steel element.

The steel element can be made of zinc plated carbon (HIT-V, HAS-(E), HIS-N), rebar, stainless steel (HIT-V-R, HAS-(E)R, HIS-RN), or high corrosion resistant stainless steel (HIT-V-HCR, HAS-(E)HCR). The steel element is placed into a rotary/percussion drilled hole filled with the injection mortar and is anchored via the bond between the metal part and concrete.

An illustration of the product is provided in Annex 1 and 2.

#### 1.2. Intended use

The anchor is intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106/EEC shall be fulfilled and failure of anchorages made with these products would compromise the stability of the works, cause risk to human life and/or lead to considerable economic consequences. Safety in case of fire (Essential Requirement 2) is not covered in this ETA. The anchor is to be used only for anchorages subject to static or quasi-static loading in reinforced or unreinforced normal weight concrete of strength classes C 20/25 at minimum and C50/60 at most according to EN 206-1: 2000-12. It may be anchored in non-cracked concrete only.

**The elements made of zinc plated carbon steel** (Threaded rods HIT-V ,HAS-(E) and internal sleeves HIS-N) may only be used in concrete subject to dry internal conditions.

**The elements made of stainless steel A4** (Threaded rods HIT-V-R ,HAS-(E)R and internal sleeves HIS-RN) may be used in structures subject to dry internal conditions and also in structures subject to external atmospheric exposure (including industrial and marine environment), or exposure in permanently damp internal conditions, if no particular aggressive conditions exist. Such 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).

**The elements made of high corrosion resistant stainless steel (HCR)** (Threaded rods HIT-V-HCR ,HAS-(E)HCR may be used in structures subject to dry internal conditions and also in structures subject to external atmospheric exposure, in permanently damp internal conditions or in other particular aggressive conditions. Such particular conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

**Elements made of rebar:**

Post-installed reinforcing bars may be used as anchor designed in accordance with the EOTA Technical Report TR 029 only. Such applications are e.g. concrete overlay or shear dowel connections or the connections of a wall predominantly loaded by shear and compression forces with the foundation, where the reinforcing bars act as dowels to take up shear forces. Connections with post-installed reinforcing bars in concrete structures designed in accordance with EN1992-1-1: 2004 are not covered by this European technical approval.

The anchor may be installed in dry or wet concrete for all diameters (use category 1).

Installation	Substrate		
	Dry concrete	Wet concrete	Flooded hole
All diameters	Yes	Yes	Not qualified

The anchor may be used in the following temperature ranges:

- 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).

The provisions made in this European Technical Approval are based on an assumed intended working life of the anchor of 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.

## 2 Characteristics of product and methods of verification

### 2.1. Characteristics of product

The steel elements and the mortar foil packs correspond to the drawings and provisions given in Annexes 1 to 2. The characteristic material values, dimensions and tolerances of the anchor not indicated in Annexes 3 to 5 shall correspond to the respective values provided in the technical documentation<sup>5</sup> of this European Technical Approval. The characteristic anchor values for the design of anchorages are provided in Annexes 11 to 18.

The two components of the Hilti HIT-HY 150 MAX injection mortar are delivered in an unmixed condition in foil packs of sizes 330 ml, 500 ml or 1400 ml according to Annex 1. Each foil pack is marked with the identifying, the trade name "Hilti HIT-HY 150 MAX", the production date, the production time and expiration date.

Each threaded rod HIT-V is marked with the marking of steel grade, size and length in accordance with Annex 3. Each threaded rod made of stainless steel is marked with the additional letter "R". Each threaded rod made of high corrosion resistant steel is marked with the additional letter "HCR".

Each threaded rod HAS-(E) is marked with the identifying mark – "H" and the embossing accordance with Annex 3. Each threaded rod made of zinc coated steel is marked with the additional embossing "1". Each threaded rod made of stainless steel is marked with the additional embossing "=". Each threaded rod made of high corrosion resistant steel is marked with the additional embossing "CR".

Each internal sleeve made of zinc coated steel is marked with "HIS-N" according to Annex 4.

Each internal sleeve made of stainless steel is marked with "HIS-RN" according to Annex 4.

Elements made of reinforcing bar shall comply with the specifications given in Annex 5.

Explanations of the markings and the corresponding materials are given in Annexes 3 to 6.

The marking of embedment depth for the steel element threaded rod HIT-V and reinforcing bar may be done on jobsite.

### 2.2. Methods of verification

The assessment of suitability of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 has been made in accordance with the « Guideline for European Technical Approval of Metal Anchors for use in Concrete », Part 1 « Anchors in general » and Part 5 « Bonded anchors », on the basis of Option 7.

*In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the UE Construction Products Directive, these requirements need also to be complied with, when and where they apply.*

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The technical documentation of this European Technical Approval is deposited at the Centre Scientifique et Technique du Bâtiment and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

### **3 Evaluation of Conformity and CE marking**

#### **3.1. Attestation of conformity system**

The system of attestation of conformity 2 (i) (referred to as system 1) according to Council Directive 89/106/EEC Annex III laid down by the European Commission provides:

a) Tasks for the manufacturer:

1. Factory production control,
2. Further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan.

b) Tasks for the approved body:

3. Initial type-testing of the product,
4. Initial inspection of factory and of factory production control,
5. Continuous surveillance, assessment and approval of factory production control.

#### **3.2. Responsibilities**

##### **3.2.1. Tasks of the manufacturer, factory production control**

The manufacturer has a factory production control system in the plant and exercises permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. This production control system ensures that the product is in conformity with the European Technical Approval.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the prescribed test plan<sup>6</sup>. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of incoming materials such as resin and hardener shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying appropriate properties.

The frequency of controls and tests conducted during production is laid down in the prescribed test plan taking account of the automated manufacturing process of the anchor.

The results of factory production control are recorded and evaluated. The records include at least the following information:

- designation of the product, basic material and components;
- type of control or testing;
- date of manufacture of the product and date of testing of the product or basic material and components;
- result of control and testing and, if appropriate, comparison with requirements;
- signature of person responsible for factory production control.

The records shall be presented to the inspection body during the continuous surveillance. On request, they shall be presented to the Centre Scientifique et Technique du Bâtiment.

Details of the extent, nature and frequency of testing and controls to be performed within the factory production control shall correspond to the prescribed test plan which is part of the technical documentation of this European Technical Approval.

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The prescribed test plan has been deposited at the Centre Scientifique et Technique du Bâtiment and is only made available to the approved bodies involved in the conformity attestation procedure.

### 3.2.2. Tasks of approved bodies

#### 3.2.2.1. Initial type-testing of the product

For initial type-testing the results of the tests performed as part of the assessment for the European Technical Approval shall be used unless there are changes in the production line or plant. In such cases the necessary initial type-testing has to be agreed between the Centre Scientifique et Technique du Bâtiment and the approved bodies involved.

#### 3.2.2.2. Initial inspection of factory and of factory production control

The approved body shall ascertain that, in accordance with the prescribed test plan, the factory and the factory production control are suitable to ensure continuous and orderly manufacturing of the anchor according to the specifications mentioned in 2.1. as well as to the Annexes to the European Technical Approval.

#### 3.2.2.3. Continuous surveillance

The approved body shall visit the factory at least once a year for regular inspection. It has to be verified that the system of factory production control and the specified automated manufacturing process are maintained taking account of the prescribed test plan.

Continuous surveillance and assessment of factory production control have to be performed according to the prescribed test plan.

The results of product certification and continuous surveillance shall be made available on demand by the certification body or inspection body, respectively, to the Centre Scientifique et Technique du Bâtiment. In cases where the provisions of the European Technical Approval and the prescribed test plan are no longer fulfilled the conformity certificate shall be withdrawn.

### 3.3. CE-Marking

The CE marking shall be affixed on each packaging of anchors. The symbol « CE » shall be accompanied by the following information:

- identification number of the certification body;
- name or identifying mark of the producer and manufacturing plant;
- the last two digits of the year in which the CE-marking was affixed;
- number of the EC certificate of conformity;
- number of the European Technical Approval;
- number of the European Technical Guideline;
- use category (ETAG 001-1 Option 7);
- size.

## **4 Assumptions under which the suitability of the product for the intended use was favourably assessed**

### **4.1. Manufacturing**

The anchor is manufactured in accordance with the provisions of the European Technical Approval using the automated manufacturing process as identified during inspection of the plant by the Centre Scientifique et Technique du Bâtiment and the approved body and laid down in the technical documentation.

### **4.2. Installation**

#### **4.2.1. Design of anchorages**

The suitability of the anchor for the intended use is given under the following conditions:

The anchorages are designed in accordance with the EOTA Technical Report TR 029<sup>7</sup> "Design of bonded anchors" 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.).

Post-installed reinforcing bars may be used as anchor designed in accordance with the EOTA Technical Report TR 029 only. The basic assumptions for the design according to anchor theory shall be observed. This includes the consideration of tension and shear loads and the corresponding failure modes as well as the assumption that the base material (concrete structural element) remains essentially in the serviceability limit state (either non-cracked or cracked) when the connection is loaded to failure. Such applications are e.g. concrete overlay or shear dowel connections or the connections of a wall predominantly loaded by shear and compression forces with the foundation, where the rebars act as dowels to take up shear forces. Connections with reinforcing bars in concrete structures designed in accordance with EN1992-1-1: 2004 (e.g. connection of a wall loaded with tension forces in one layer of the reinforcement with the foundation) are not covered by this European technical approval.

For the internal sleeve only fastening screws or threaded rods made of galvanised steel with the minimum strength class 8.8 EN ISO 898-1 shall be used. The minimum and maximum thread engagement length  $h_s$  of the fastening screw or the threaded rod for installation of the fixture shall be met the requirements according to Annex 4, Table 2. The length of the fastening screw or the threaded rod shall be determined depending on thickness of fixture, admissible tolerances, available thread length and minimum and maximum thread engagement length  $h_s$ .

#### **4.2.2. Installation of anchors**

The suitability for use of the anchor can only be assumed if the anchor is installed as follows:

- anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters on the site;
- use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor;
- anchor installation in accordance with the manufacturer's specifications and drawings using the tools indicated in the technical documentation of this European Technical Approval;
- checks before placing the anchor to ensure that the strength class of the concrete in which the anchor is to be placed is in the range;
- check of concrete being well compacted, e.g. without significant air voids;
- keeping the effective anchorage depth;

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<sup>7</sup> The Technical Report TR 029 "Design of Bonded Anchors" is published in English on EOTA website [www.eota.eu](http://www.eota.eu).



- keeping of the edge distance and spacing to the specified values without minus tolerances;
- positioning of the drill holes without damaging the reinforcement;
- in case of aborted drill hole: the drill hole shall be filled with mortar;
- clean the hole in accordance with Annexes 7 to 9; before brushing clean the brush and checking whether the brush diameter according to Annex 10 Table 6 is sufficient. The brush shall produce natural resistance as it enters the anchor hole. If this is not the case a new brush or a brush with a larger diameter must be used;
- anchor installation ensuring the specified embedment depth, that is the appropriate depth marking of the anchor not exceeding the concrete surface;
- for overhead installation piston plugs shall be used, embedded metal parts shall be fixed with during the curing time, e.g. with wedges,
- for injection of the mortar in bore holes  $\geq 250$  mm piston plugs shall be used
- mortar injection by using the equipment including the special mixing nozzle shown in Annex 1; discarding the first portion of mortar of each new cartridge until an homogeneous colour is achieved; taking from the manufacturer instruction the admissible processing time (open time) of a cartridge as a function of the ambient temperature of the concrete; filling the drill hole uniformly from the drill hole bottom, in order to avoid entrapment of air; removing the special mixing nozzle slowly bit by bit during pressing-out; filling the drill hole with a quantity of the injection mortar corresponding to 2/3 of the drill hole; inserting immediately the threaded rod, slowly and with a slight twisting motion, removing excess of injection mortar around the rod; observing the curing time according to Annex 9 table 5 until the rod may be loaded; during curing of the injection mortar the temperature of the concrete must not fall below  $-10^{\circ}\text{C}$ ;
- fastening screws or threaded rods (including nut and washer) for the internal sleeves HIS-(R)N must be made of appropriate steel grade and property class,
- application of the torque moment given in Annex 3 table 1 and Annex 4 table 2 using a calibrated torque wrench.

#### 4.2.3. Responsibility of the manufacturer

It is the manufacturer's responsibility to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to in 4.2.1. and 4.2.2. is given to those who are concerned. This information may be made by reproduction of the respective parts of the European Technical Approval. In addition all installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

The minimum data required are:

- drill bit diameter,
- hole depth,
- diameter of anchor rod,
- minimum effective anchorage depth,
- information on the installation procedure, including cleaning of the hole with the cleaning equipments, preferably by means of an illustration,
- material and property class of metal parts acc. to Annex 6, Table 4,
- anchor component installation temperature,
- ambient temperature of the concrete during installation of the anchor,
- admissible processing time (open time) of the mortar,
- curing time until the anchor may be loaded as a function of the ambient temperature in the concrete during installation,
- maximum torque moment,
- identification of the manufacturing batch,

All data shall be presented in a clear and explicit form.

## **5 Recommendations concerning packaging, transport and storage.**

The mortar cartridges shall be protected against sun radiation and shall be stored according to the manufacturer's installation instructions in dry conditions at temperatures of at least 5°C to not more than +25°C.

Mortar cartridges with expired shelf life must no longer be used.

The anchor shall only be packaged and supplied as a complete unit. Foil packs may be packed separately from metal parts.

**The original French version is  
signed by**

**Le Directeur Technique  
H. BERRIER**

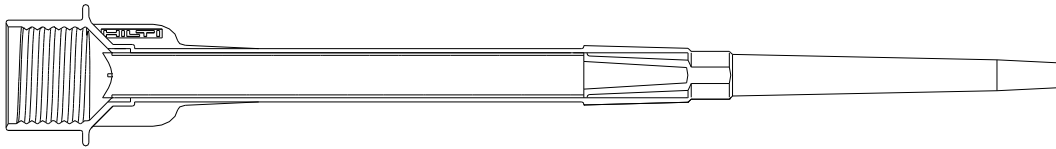
**Injection mortar:** hybrid system with resin, hardener and cement water component

Foil pack 330ml, 500ml and 1400ml

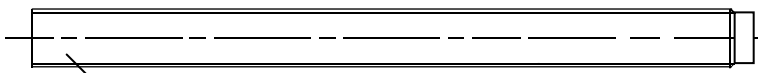
Marking  
 HILTI HIT  
 production date  
 production time  
 expiration date



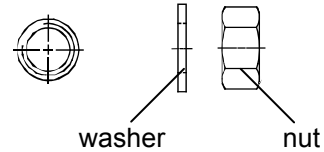
**Static Mixer HIT-RE**



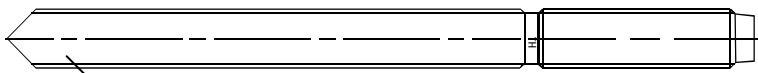
**Steel elements:**



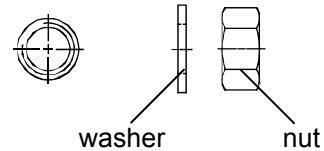
**Threaded rod HIT-V ...**  
 thread sizes M8, M10, M12, M16, M20, M24, M27 or M30



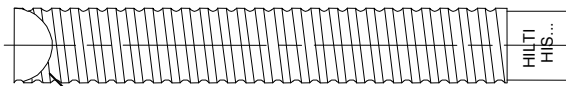
washer nut



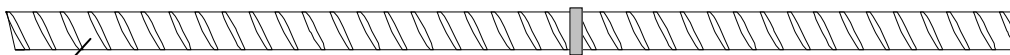
**threaded rod HAS-(E) ...**  
 thread sizes M8, M10, M12, M16, M20, M24, M27 or M30



washer nut



**Internal sleeve HIS-(R)N ...**  
 Thread sizes M8, M10, M12, M16 or M20



**Rebar**  
 diameter  $\varnothing 8$ ,  $\varnothing 10$ ,  $\varnothing 12$ ,  $\varnothing 14$ ,  $\varnothing 16$ ,  $\varnothing 20$ ,  $\varnothing 25$

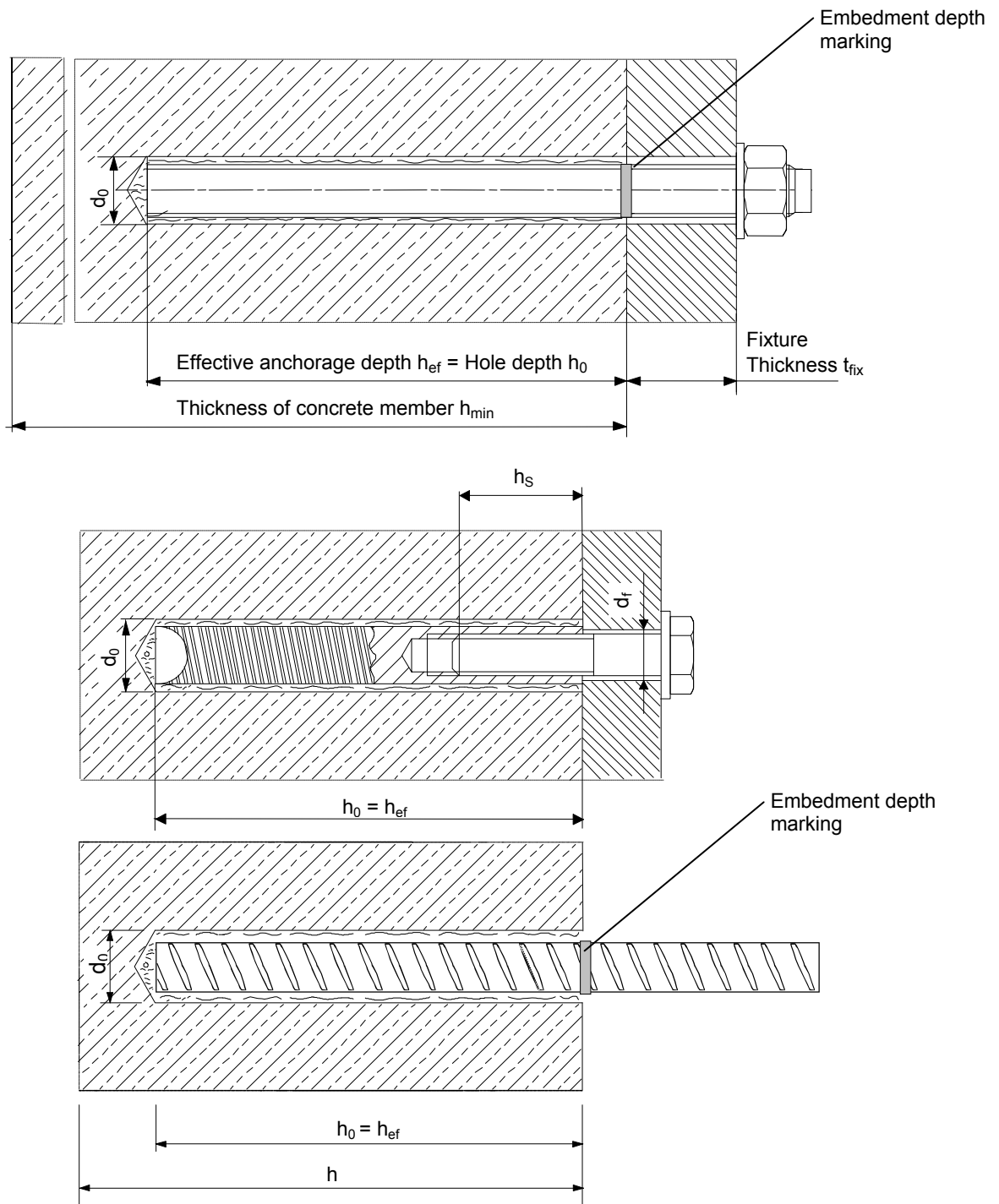
**Injection System Hilti HIT-HY 150 MAX**

**Product and intended use I**

**Annex 1**

of European  
 technical approval

**ETA – 08/0352**



<b>Use category:</b>	<b>Installation in dry or water saturated concrete, (not in flooded holes)</b>	
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)

**Injection System Hilti HIT-HY 150 MAX**

**Product and intended use II**

**Annex 2**

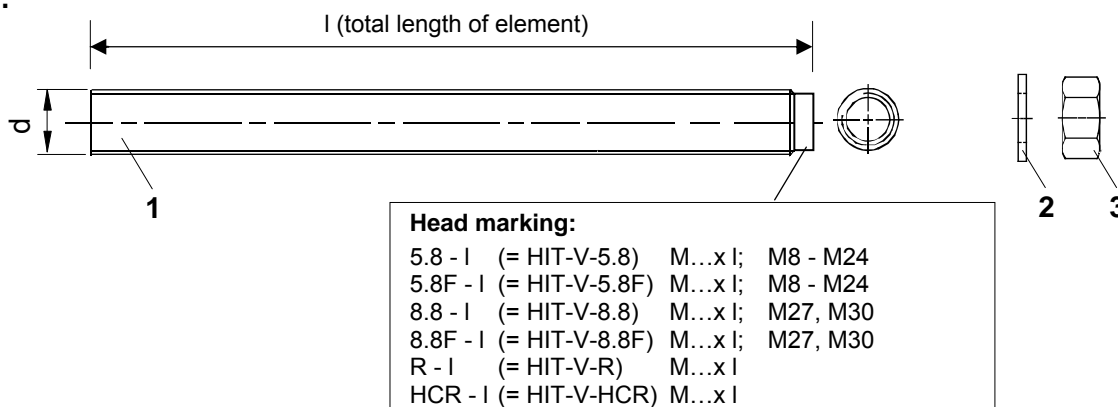
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**ETA – 08/0352**

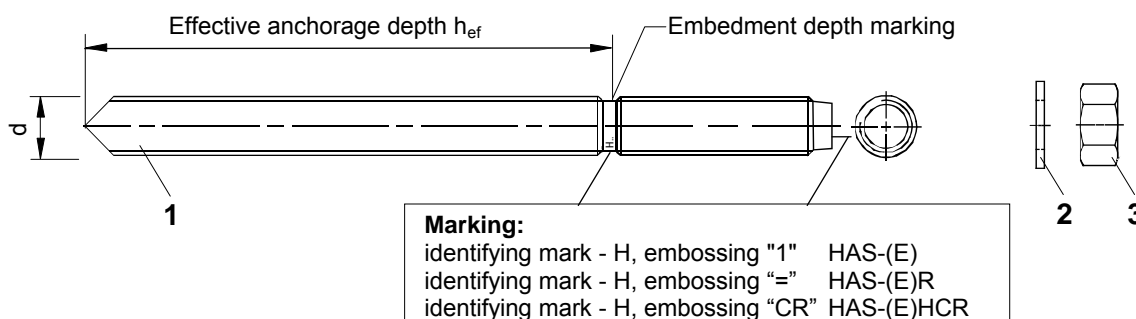
**Table 1: Installation parameters threaded rod HIT-V... and HAS-(E)...**

HIT-HY 150 MAX with HIT-V and HAS-(E)			M8	M10	M12	M16	M20	M24	M27	M30
Diameter of element	d	[mm]	8	10	12	16	20	24	27	30
Range of anchorage depth $h_{ef}$ and bore hole depth $h_0$	min	[mm]	60	60	70	80	90	100	110	120
	max	[mm]	160	200	240	320	400	480	540	600
Effective anchorage depth <b>HAS-(E)...</b>	$h_{ef}$	[mm]	80	90	110	125	170	210	240	270
Nominal diameter of drill bit	$d_0$	[mm]	10	12	14	18	24	28	30	35
Diameter of clearance hole in the fixture	$d_f$	[mm]	9	12	14	18	22	26	30	33
Maximum torque moment	$T_{max}$	[Nm]	10	20	40	80	150	200	270	300
Minimum thickness of concrete member	$h_{min}$	[mm]	$h_{ef} + 30 \text{ mm}$ $\geq 100 \text{ mm}$			$h_{ef} + 2d_0$				
Minimum spacing	$s_{min}$	[mm]	40	50	60	80	100	120	135	150
Minimum edge distance	$c_{min}$	[mm]	40	50	60	80	100	120	135	150

**HIT-V...**



**HAS-(E)...**



**Injection System Hilti HIT-HY 150 MAX**

**Installation parameters  
 Threaded rod HIT-V and HAS-(E)**

**Annex 3**

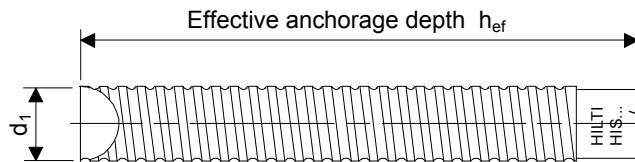
of European  
 technical approval

**ETA - 08/0352**

**Table 2: Installation parameters of internal sleeve HIS-(R)N**

HIT-HY 150 MAX with HIS-(R)N			M 8	M 10	M 12	M 16	M 20
Diameter of sleeve	$d_1$	[mm]	12,5	16,5	20,5	25,4	27,6
Effective anchorage depth	$h_{ef}$	[mm]	90	110	125	170	205
Nominal diameter of drill bit	$d_0$	[mm]	14	18	22	28	32
Depth of drilled hole	$h_0$	[mm]	90	110	125	170	205
Diameter of clearance hole in the fixture	$d_f$	[mm]	9	12	14	18	22
Maximum torque moment	$T_{max}$	[Nm]	10	20	40	80	150
Thread engagement length min-max	$h_s$	[mm]	8-20	10-25	12-30	16-40	20-50
Minimum thickness of concrete member	$h_{min}$	[mm]	120	150	170	230	270
Minimum spacing	$s_{min}$	[mm]	40	45	55	65	90
Minimum edge distance	$c_{min}$	[mm]	40	45	55	65	90

**HIT-(R)N...**



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

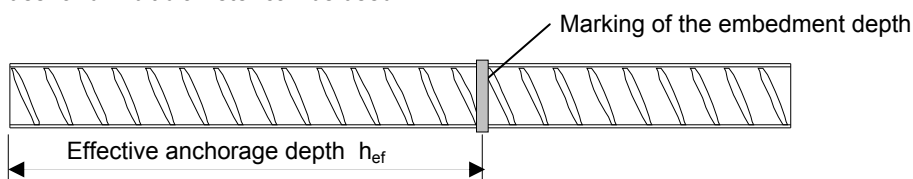
<b>Injection System Hilti HIT-HY 150 MAX</b>	<b>Annex 4</b>  of European technical approval  <b>ETA – 08/0352</b>
<b>Installation parameters Internal sleeve HIS-(R)N</b>	

**Table 3: Installation parameters of anchor element rebar**

HIT-HY 150 MAX rebar		Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25
Diameter of element	d [mm]	8	10	12	14	16	20	25
Range of anchorage depth ( $h_{ef}$ ) and bore hole depth ( $h_0$ )	min [mm]	60	60	70	75	80	90	100
	max [mm]	160	200	240	280	320	400	500
Nominal diameter of drill bit	$d_0$ [mm]	10-12 <sup>1)</sup>	12-14 <sup>1)</sup>	14-16 <sup>1)</sup>	18	20	25	32
Minimum thickness of concrete member	$h_{min}$ [mm]	$h_{ef} + 30\text{mm}$ $\geq 100\text{ mm}$			$h_{ef} + 2d_0$			
Minimum spacing	$s_{min}$ [mm]	40	50	60	70	80	100	125
Minimum edge distance	$c_{min}$ [mm]	40	50	60	70	80	100	125

1) Both given values for drill bit diameter can be used

**Rebar**



Refer to EN 1992-1-1 Annex C Table C.1 and C.2N, Properties of reinforcement:

Product form		Bars and de-coiled rods	
Class		B	C
Characteristic yield strength $f_{yk}$ or $f_{0,2k}$ (MPa)		400 to 600	
Minimum value of $k = (f_t/f_y)_k$		$\geq 1,08$	$\geq 1,15$ $< 1,35$
Characteristic strain at maximum force, $\epsilon_{uk}$ (%)		$\geq 5,0$	$\geq 7,5$
Bendability		Bend/Rebend test	
Maximum deviation from nominal mass (individual bar) (%)	Nominal bar size (mm) $\leq 8$	$\pm 6,0$ $\pm 4,5$	
	$> 8$		
Bond: Minimum relative rib area, $f_{R,min}$ (determination according to EN 15630)	Nominal bar size (mm) 8 to 12	0,040 0,056	
	$> 12$		

**Height of the rebar rib  $h_{rib}$ :**

The height of the rebar rib  $h_{rib}$  shall fulfil the following requirement:  $0,05 * d \leq h_{rib} \leq 0,07 * d$   
 with: d = nominal diameter of the rebar element

**Injection System Hilti HIT-HY 150 MAX**

**Installation parameters rebar**

**Annex 5**

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**Table 4: Materials**

Designation	Material
<b>Metal parts made of rebar</b>	
Rebar	See annex 5
<b>Metal parts made of zinc coated steel</b>	
threaded rod HIT-V-5.8(F) HAS-(E) M8 to M24	strength class 5.8 EN ISO 898-1, A <sub>5</sub> > 8% Ductile steel galvanized ≥ 5µm EN ISO 4042 (F) hot dipped galvanized ≥ 45µm EN ISO 10684
threaded rod HIT-V-8.8(F) HAS-(E) M27 and M30	strength class 8.8 EN ISO 898-1, A <sub>5</sub> > 8% Ductile steel galvanized ≥ 5µm EN ISO 4042 (F) hot dipped galvanized ≥ 45µm EN ISO 10684
washer ISO 7089	steel galvanized EN ISO 4042; hot dipped galvanized EN ISO 10684
nut EN ISO 4032	strength class 8 ISO 898-2 steel galvanized ≥ 5µm EN ISO 4042 hot dipped galvanized ≥ 45µm EN ISO 10684
internally threaded sleeves <sup>1)</sup> HIS-N	C-Stahl 1.0718, EN 10277-3 steel galvanized ≥ 5µm EN ISO 4042
<b>Metal parts made of stainless steel</b>	
threaded rod HIT-V-R HAS-(E)R	for ≤ M24: strength class 70 EN ISO 3506-1; A <sub>5</sub> > 8% Ductile for > M24: strength class 50 EN ISO 3506-1; A <sub>5</sub> > 8% Ductile stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088
washer ISO 7089	stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088
nut EN ISO 4032	strength class 70 EN ISO 3506-2 stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088
internally threaded sleeves <sup>2)</sup> HIS-RN	stainless steel 1.4401 und 1.4571 EN 10088
<b>Metal parts made of high corrosion resistant steel</b>	
threaded rod HIT-V-HCR HAS-(E)HCR	for ≤ M20: R <sub>m</sub> = 800 N/mm <sup>2</sup> ; R <sub>p 0,2</sub> = 640 N/mm <sup>2</sup> , A <sub>5</sub> > 8% Ductile for > M20: R <sub>m</sub> = 700 N/mm <sup>2</sup> ; R <sub>p 0,2</sub> = 400 N/mm <sup>2</sup> , A <sub>5</sub> > 8% Ductile high corrosion resistant steel 1.4529, 1.4565 EN 10088
washer ISO 7089	high corrosion resistant steel 1.4529, 1.4565 EN 10088
nut EN ISO 4032	strength class 70 EN ISO 3506-2 high corrosion resistant steel 1.4529, 1.4565 EN 10088

1) related fastening screw: strength class 8.8 EN ISO 898-1, A<sub>5</sub> > 8% Ductile steel galvanized ≥ 5µm EN ISO 4042  
 2) related fastening screw: strength class 70 EN ISO 3506-1, A<sub>5</sub> > 8% Ductile stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088

**Injection System Hilti HIT-HY 150 MAX**

**Materials**

**Annex 6**

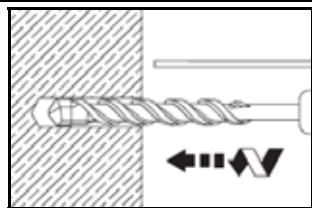
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**Instruction for use**

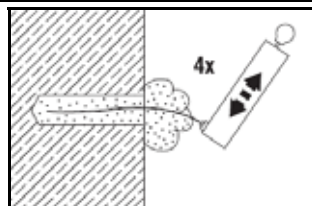
**Bore hole drilling**



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

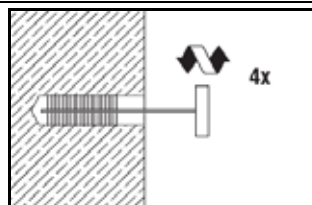
**Bore hole cleaning** Just before setting an anchor, the bore hole must be free of dust and debris.

**a) Manual air cleaning (MAC)** for bore hole diameters  $d_0 \leq 18$  mm and bore hole depth  $h_0 \leq 10d$

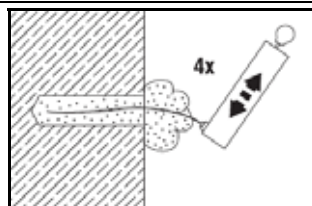


The Hilti manual pump may be used for blowing out bore holes up to diameters  $d_0 \leq 18$  mm and embedment depths up to  $h_{ef} \leq 10d$ .

Blow out at least 4 times from the back of the bore hole until return air stream is free of noticeable dust.

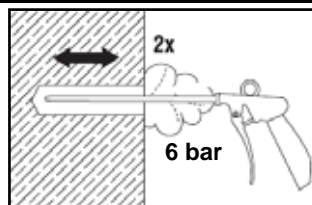


Brush 4 times with the specified brush size (brush  $\varnothing \geq$  bore hole  $\varnothing$ , see Table 6) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the bore hole. If not, the brush is too small and must be replaced with the proper brush diameter.

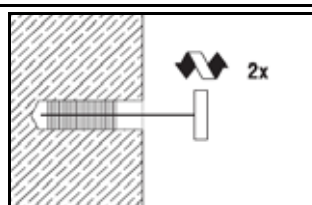


Blow out again with manual pump at least 4 times until return air stream is free of noticeable dust.

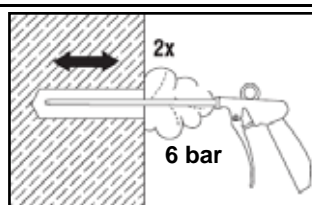
**b) Compressed air cleaning (CAC)** for all bore hole diameters  $d_0$  and all bore hole depth  $h_0$



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 m<sup>3</sup>/h) until return air stream is free of noticeable dust.



Brush 2 times with the specified brush size (brush  $\varnothing \geq$  bore hole  $\varnothing$ , see Table 6) 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 bore hole. 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 150 MAX**

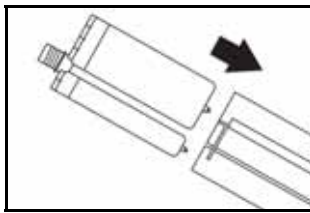
**Installation instruction I  
 Borehole drilling, borehole cleaning**

**Annex 7**

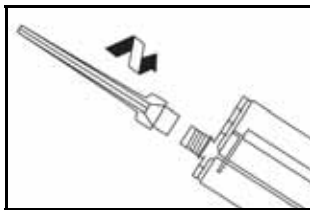
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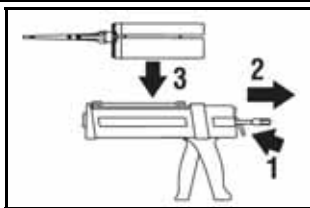
**Injection preparation**



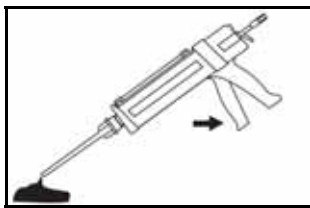
Insert foil pack in foil pack holder. Never use damaged foil packs and/or damaged or unclean foil pack holders. Attach new mixer prior to dispensing a new foil pack (snug fit).



Tightly attach mixer to foil pack manifold. Do not modify the mixer in any way. Make sure the mixing element is in the mixer. Use only the mixer supplied with the adhesive.

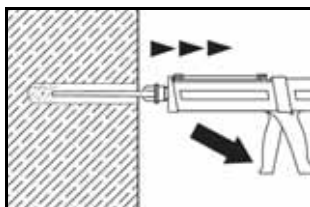


Insert foil pack holder with foil pack into HIT-dispenser. Push release trigger, retract plunger and insert foil pack holder into the appropriate Hilti dispenser.

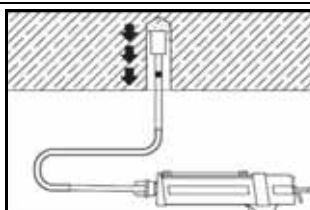


Discard initial adhesive. The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.  
 Discard quantities are 2 strokes for 330ml foil pack,  
 3 strokes for 500ml foil pack and  
 45 ml for 1400ml foil pack.

**Inject adhesive**



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 installation with embedment depth  $h_{ef} > 250\text{mm}$   
 For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble mixer, extension(s) and appropriately sized piston plug (see Table 6).



Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the bore hole by the adhesive pressure.

**Injection System Hilti HIT-HY 150 MAX**

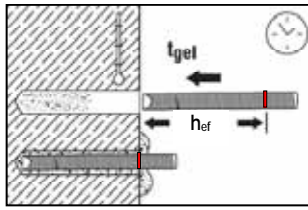
**Annex 8**

**Installation Instruction II  
 Injection preparation, inject adhesive**

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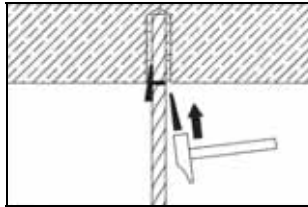
**ETA – 08/0352**

### Setting the element

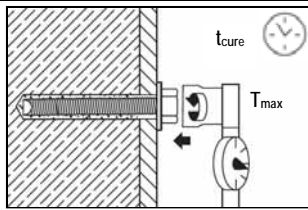


Before use, verify that the element is dry and free of oil and other contaminants.

Mark and set element to the required embedment depth till working time  $t_{gel}$  has elapsed. The working time  $t_{gel}$  is given in Table 5.



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



Loading the anchor:

After required curing time  $t_{cure}$  (see Table 5) the anchor can be loaded. The applied installation torque shall not exceed the values  $T_{max}$  given in Table 1 and Table 2.

**Table 5: Working time, curing time**

Base material temperature	Working time “ $t_{gel}$ ”	Curing time “ $t_{cure}$ ”
$-10\text{ °C} \leq T_{\text{base material}} < -5\text{ °C}$ <sup>1)</sup>	180 min	12 h
$-5\text{ °C} \leq T_{\text{base material}} < 0\text{ °C}$	40 min	4 h
$0\text{ °C} \leq T_{\text{base material}} < 5\text{ °C}$	20 min	2 h
$5\text{ °C} \leq T_{\text{base material}} < 20\text{ °C}$	8 min	1 h
$20\text{ °C} \leq T_{\text{base material}} < 30\text{ °C}$	5 min	30 min
$30\text{ °C} \leq T_{\text{base material}} \leq 40\text{ °C}$	2 min	30 min

1) The cartridge temperature must be between 20°C and 25°C

**Injection System Hilti HIT-HY 150 MAX**







**Installation Instruction III**  
**Working time, curing time**

**Annex 9**

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**Table 6: Bore hole cleaning: Steel brush – Installation with Piston Plug**

Element	Size	Nominal drill bit diameter $d_0$ [mm]	Steel brush HIT-RB	Piston plug HIT-SZ	Cleaning methods	
					Manual cleaning (MAC)	Compressed air cleaning (CAC)
					Manual cleaning (MAC)	Compressed air cleaning (CAC)
<b>HIT-V / HAS</b> 	M8	10	HIT-RB 10	-	Yes ... $h_{ef} \leq 80\text{mm}$	Yes
	M10	12	HIT-RB 12	HIT-SZ 12	Yes ... $h_{ef} \leq 100\text{mm}$	Yes
	M12	14	HIT-RB 14	HIT-SZ 14	Yes ... $h_{ef} \leq 120\text{mm}$	Yes
	M16	18	HIT-RB 18	HIT-SZ 18	Yes ... $h_{ef} \leq 160\text{mm}$	Yes
	M20	24	HIT-RB 24	HIT-SZ 24	No	Yes
	M24	28	HIT-RB 28	HIT-SZ 28	No	Yes
	M27	30	HIT-RB 30	HIT-SZ 30	No	Yes
	M30	35	HIT-RB 35	HIT-SZ 35	No	Yes
<b>HIS-(R)N</b> 	M8	14	HIT-RB 14	HIT-SZ 14	Yes	Yes
	M10	18	HIT-RB 18	HIT-SZ 18	Yes	Yes
	M12	22	HIT-RB 22	HIT-SZ 22	No	Yes
	M16	28	HIT-RB 28	HIT-SZ 28	No	Yes
	M20	32	HIT-RB 32	HIT-SZ 32	No	Yes
<b>Rebar</b> 	$\varnothing 8$	10 to 12	HIT-RB 10 to 12	HIT-SZ 10 to 12	Yes ... $h_{ef} \leq 80\text{mm}$	Yes
	$\varnothing 10$	12 to 14	HIT-RB 12 to 14	HIT-SZ 12 to 14	Yes ... $h_{ef} \leq 100\text{mm}$	Yes
	$\varnothing 12$	14 to 16	HIT-RB 14 to 16	HIT-SZ 14 to 16	Yes ... $h_{ef} \leq 120\text{mm}$	Yes
	$\varnothing 14$	18	HIT-RB 18	HIT-SZ 18	Yes ... $h_{ef} \leq 140\text{mm}$	Yes
	$\varnothing 16$	20	HIT-RB 20	HIT-SZ 20	No	Yes
	$\varnothing 20$	25	HIT-RB 25	HIT-SZ 25	No	Yes
	$\varnothing 25$	32	HIT-RB 32	HIT-SZ 32	No	Yes

**Manual Cleaning (MC):**

Hilti hand pump recommended for blowing out bore holes with diameters  $d_0 \leq 18$  mm and bore hole depth  $h_0 \leq 10d$

**Compressed air cleaning (CAC):**

Recommended air nozzle with an orifice opening of minimum 3,5 mm in diameter.



**Injection System Hilti HIT-HY 150 MAX**

**Annex 10**

**Bore hole cleaning**

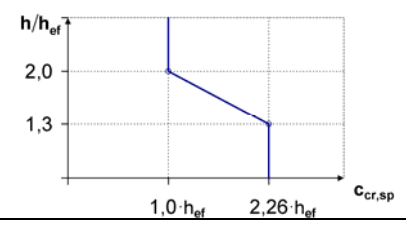
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**Steel brush - Installation with piston plug**

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**Table 7: Design method A, Characteristic tension load values**

HIT-HY 150 MAX with HIT-V... or HAS(-E)-...	M8	M10	M12	M16	M20	M24	M27	M30
<b>Steel failure HIT-V...</b>								
Characteristic resistance HIT-V-5.8(F) $N_{Rk,s}$ [kN]	18	29	42	79	123	177	230	281
Characteristic resistance HIT-V-8.8(F) $N_{Rk,s}$ [kN]	29	46	67	126	196	282	367	449
Partial safety factor $\gamma_{Ms,N}^{1)}$ [-]	1,5							
Characteristic resistance HIT-V-R $N_{Rk,s}$ [kN]	26	41	59	110	172	247	230	281
Partial safety factor $\gamma_{Ms,N}^{1)}$ [-]	1,87						2,86	
Characteristic resistance HIT-V-HCR $N_{Rk,s}$ [kN]	29	46	67	126	196	247	321	393
Partial safety factor $\gamma_{Ms,N}^{1)}$ [-]	1,5					2,1		
<b>Steel failure HAS(-E)...</b>								
Characteristic resistance HAS(E)-5.8 $N_{Rk,s}$ [kN]	17	26	38	72	112	160	-	-
Characteristic resistance HAS(E)-8.8 $N_{Rk,s}$ [kN]	-	-	-	-	-	-	347	422
Partial safety factor $\gamma_{Ms,N}^{1)}$ [-]	1,5							
Characteristic resistance HAS(E)-R $N_{Rk,s}$ [kN]	23	37	53	101	157	224	217	263
Partial safety factor $\gamma_{Ms,N}^{1)}$ [-]	1,87						2,86	
Characteristic resistance HAS(E)-HCR $N_{Rk,s}$ [kN]	27	42	61	115	180	224	304	369
Partial safety factor $\gamma_{Ms,N}^{1)}$ [-]	1,5					2,1		
<b>Combined Pull-out and Concrete cone failure <sup>2)</sup></b>								
Diameter of threaded rod $d$ [mm]	8	10	12	16	20	24	27	30
Characteristic bond resistance in non-cracked concrete C20/25								
Temperature range I <sup>3)</sup> : 40°C / 24°C $\tau_{Rk}$ [N/mm <sup>2</sup> ]	14,0	14,0	14,0	13,0	12,0	11,0	10,0	8,5
Temperature range II <sup>3)</sup> : 80°C / 50°C $\tau_{Rk}$ [N/mm <sup>2</sup> ]	12,0	12,0	12,0	12,0	11,0	10,0	9,0	7,0
Temperature range III <sup>3)</sup> : 120°C / 72°C $\tau_{Rk}$ [N/mm <sup>2</sup> ]	8,0	8,0	8,0	7,0	6,5	6,0	5,5	4,5
Increasing factor for $\tau_{Rk,p}$ in non cracked concrete	C30/37	1,04						
	C40/50	1,07						
	C50/60	1,09						
<b>Splitting failure <sup>2)</sup></b>								
Edge distance $c_{cr,sp}$ [mm] for	$h / h_{ef} \geq 2,0$	1,0 $h_{ef}$						
	$2,0 > h / h_{ef} > 1,3$	4,6 $h_{ef}$ - 1,8 $h$						
	$h / h_{ef} \leq 1,3$	2,26 $h_{ef}$						
Spacing $s_{cr,sp}$ [mm]	2 $c_{cr,sp}$							
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}^{1)}$ [-]	1,8 <sup>4)</sup>	1,8 <sup>4)</sup>	1,8 <sup>4)</sup>	1,5 <sup>5)</sup>	1,5 <sup>5)</sup>	1,5 <sup>5)</sup>	1,5 <sup>5)</sup>	1,8 <sup>4)</sup>



- 1) In absence of national regulations
- 2) Calculation of concrete failure and splitting see chapter 4.2.1
- 3) Explanation see chapter 1.2
- 4) The partial safety factor  $\gamma_2 = 1,2$  is included.
- 5) The partial safety factor  $\gamma_2 = 1,0$  is included.

**Injection System Hilti HIT-HY 150 MAX**

**Characteristic tension load values  
 Threaded rods HIT-V and HAS(-E)**

**Annex 11**

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**Table 8: Displacement under tension load in mm/(N/mm<sup>2</sup>)<sup>1)</sup>**

HIT-HY 150 MAX with HIT-V-... / HAS(-E)-...			M8	M10	M12	M16	M20	M24	M27	M30
<b>Temperature range I<sup>2)</sup>: 40°C / 24°C</b>										
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0.09	0.09	0.09	0.10	0.10	0.11	0.11	0.12
<b>Temperature range II<sup>2)</sup>: 80°C / 50°C</b>										
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0.09	0.09	0.09	0.10	0.10	0.11	0.11	0.12
<b>Temperature range III<sup>2)</sup>: 120°C / 72°C</b>										
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0.09	0.09	0.09	0.10	0.10	0.11	0.11	0.12
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0.13	0.13	0.14	0.14	0.15	0.16	0.17	0.17

1) Calculation of displacement under service load:  $\tau_{Sd}$  design value of bond stress

Displacement under short term loading =  $\delta_{N0} \cdot \tau_{Sd} / 1,4$

Displacement under long term loading =  $\delta_{N\infty} \cdot \tau_{Sd} / 1,4$

2) Explanation see chapter 1.2

**Injection System Hilti HIT-HY 150 MAX**

**Displacement under tension load  
for threaded rods HIT-V and HAS(-E)**

**Annex 12**

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**Table 9: Design method A, Characteristic shear load values**

HIT-HY 150 MAX with HIT-V-... / HAS(-E)-...		M 8	M 10	M 12	M 16	M 20	M 24	M 27	M 30
<b>Steel failure<sup>1)</sup> without lever arm</b>									
Characteristic resistance HIT-V-5.8(F)	$V_{Rk,s}$ [kN]	9	15	21	39	61	88	115	140
Characteristic resistance HIT-V-8.8(F)	$V_{Rk,s}$ [kN]	15	23	34	63	98	141	184	224
Characteristic resistance HIT-V-R	$V_{Rk,s}$ [kN]	13	20	30	55	86	124	115	140
Characteristic resistance HIT-V-HCR	$V_{Rk,s}$ [kN]	15	23	34	63	98	124	161	196
Characteristic resistance HAS(-E)-5.8	$V_{Rk,s}$ [kN]	8,5	13	19	36	56	80	-	-
Characteristic resistance HAS(-E)-8.8	$V_{Rk,s}$ [kN]	-	-	-	-	-	-	174	211
Characteristic resistance HAS(-E)-R	$V_{Rk,s}$ [kN]	12	19	27	51	79	112	108	132
Characteristic resistance HAS(-E)-HCR	$V_{Rk,s}$ [kN]	13	21	31	58	90	112	152	184
<b>Steel failure with lever arm</b>									
Characteristic resistance HIT-V-5.8(F)	$M^0_{Rk,s}$ [Nm]	19	37	66	167	325	561	832	1125
Characteristic resistance HIT-V-8.8(F)	$M^0_{Rk,s}$ [Nm]	30	60	105	266	519	898	1332	1799
Characteristic resistance HIT-V-R	$M^0_{Rk,s}$ [Nm]	26	52	92	233	454	786	832	1124
Characteristic resistance HIT-V-HCR	$M^0_{Rk,s}$ [Nm]	30	60	105	266	520	786	1165	1574
Characteristic resistance HAS(-E)-5.8	$M^0_{Rk,s}$ [Nm]	16	33	56	147	284	486	-	-
Characteristic resistance HAS(-E)-8.8	$M^0_{Rk,s}$ [Nm]	-	-	-	-	-	-	1223	1637
Characteristic resistance HAS(-E)-R	$M^0_{Rk,s}$ [Nm]	23	45	79	205	398	680	764	1023
Characteristic resistance HAS(-E)-HCR	$M^0_{Rk,s}$ [Nm]	26	52	90	234	455	680	1070	1433
<b>Partial safety factor steel failure</b>									
HIT-V / HAS(-E) grade 5.8 or 8.8	$\gamma_{Ms,V}^{2)}$ [-]	1,25							
HIT-V-R / HAS(-E)-R	$\gamma_{Ms,V}^{2)}$ [-]	1,56						2,38	
HIT-V-HCR / HAS(-E)-HCR	$\gamma_{Ms,V}^{2)}$ [-]	1,25					1,75		
<b>Concrete pryout failure</b>									
Factor in equation (5.7) of Technical Report TR 029 for the design of bonded anchors	k [-]	2,0 for $h_{ef} \geq 60\text{mm}$							
Partial safety factor	$\gamma_{Mcp}^{2)}$ [-]	1,5 <sup>3)</sup>							
<b>Concrete edge failure<sup>4)</sup></b>									
Partial safety factor	$\gamma_{Mc}^{2)}$ [-]	1,5 <sup>3)</sup>							

- 1) Acc. chapter 4.2.2. commercial standard rods that fulfill the ductility requirement  $A_5 > 8\%$  (see Table 4) can be used only.  
 2) In absence of national regulations.  
 3) The partial safety factor  $\gamma_2 = 1,0$  is included.  
 4) Concrete edge failure see chapter 5.2.3.4 of Technical Report TR 029.

**Table 10: Displacement under shear load in mm/kN<sup>1)</sup>**

HIT-HY 150 MAX with HIT-V-... / HAS(-E)-...		M8	M10	M12	M16	M20	M24	M27	M30
Displacement	$\delta_{V0}$ [mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
Displacement	$\delta_{V\infty}$ [mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05

- 1) Calculation of displacement under service load:  $V_{Sd}$  design value of shear stress  
 Displacement under short term loading =  $\delta_{N0} \cdot V_{Sd} / 1,4$   
 Displacement under long term loading =  $\delta_{N\infty} \cdot V_{Sd} / 1,4$

**Injection System Hilti HIT-HY 150 MAX**

**Characteristic shear load values  
 and displacement under shear load  
 Threaded rods HIT-V and HAS(-E)**

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**Table 11: Design method A, Characteristic tension load values**

HIT-HY 150 MAX with rebar				Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	
<b>Steel failure rebar</b>											
Characteristic tension resistance for Rebar BSt 500 S acc. DIN 488 <sup>1)</sup> $N_{Rk,s}$ [kN]				28	43	62	85	111	173	270	
Partial safety factor for Rebar BSt 500 S acc. DIN 488 <sup>2)</sup> $\gamma_{Ms,N}$ <sup>3)</sup> [-]				1,4							
<b>Combined Pull-out and Concrete cone failure <sup>4)</sup></b>											
Diameter of the rebar $d$ [mm]				8	10	12	14	16	20	25	
Characteristic bond resistance in non-cracked concrete C20/25											
Temperature range I <sup>5)</sup> : 40°C/24°C $\tau_{Rk}$ [N/mm <sup>2</sup> ]				9,5	9,5	9,5	9,5	9,5	9,5	9,5	
Temperature range II <sup>5)</sup> : 80°C/50°C $\tau_{Rk}$ [N/mm <sup>2</sup> ]				8,0	8,0	8,0	8,0	8,0	8,0	8,0	
Temperature range III <sup>5)</sup> : 120°C/72°C $\tau_{Rk}$ [N/mm <sup>2</sup> ]				5,0	5,0	5,0	5,0	5,0	5,0	5,0	
Increasing factor for $\tau_{Rk,p}$ in non cracked concrete				C30/37	1,04						
				$\psi_c$ C40/50	1,07						
				C50/60	1,09						
<b>Splitting failure <sup>4)</sup></b>											
Edge distance $c_{cr,sp}$ [mm] for				$h / h_{ef} \geq 2,0$	1,0 $h_{ef}$						
				$2,0 > h / h_{ef} > 1,3$	4,6 $h_{ef}$ - 1,8 h						
				$h / h_{ef} \leq 1,3$	2,26 $h_{ef}$						
Spacing $s_{cr,sp}$ [mm]				2 $c_{cr,sp}$							
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ <sup>3)</sup> [-]				1,8 <sup>6)</sup>	1,8 <sup>6)</sup>	1,8 <sup>6)</sup>	1,8 <sup>6)</sup>	1,5 <sup>7)</sup>	1,5 <sup>7)</sup>	1,8 <sup>6)</sup>	

- 1) The characteristic tension resistance  $N_{Rk,s}$  for rebars that do not fulfill the requirements acc. DIN 488 shall be calculated acc. Technical Report TR 029, Equation (5.1).
- 2) The partial safety factor  $\gamma_{Ms,N}$  for rebars that do not fulfill the requirements acc. DIN 488 shall be calculated acc. Technical Report TR 029, Equation (3.3a).
- 3) In absence of national regulations
- 4) Calculation of concrete failure and splitting see chapter 4.2.1
- 5) Explanation see chapter 1.2
- 6) The partial safety factor  $\gamma_2 = 1.2$  is included
- 7) The partial safety factor  $\gamma_2 = 1.0$  is included

**Regarding design of post-installed rebar as anchor see chapter 4.2.1**

**Injection System Hilti HIT-HY 150 MAX**

**Characteristic tension load values Rebar**

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**Table 12: Displacement under tension load in mm/(N/mm<sup>2</sup>)<sup>1)</sup>**

HIT-HY 150 MAX with rebar			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25
<b>Temperature range I<sup>2)</sup>: 40°C / 24°C</b>									
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0.06	0.06	0.06	0.07	0.07	0.07	0.08
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0.09	0.09	0.09	0.10	0.10	0.10	0.11
<b>Temperature range II<sup>2)</sup>: 80°C / 50°C</b>									
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0.06	0.06	0.06	0.07	0.07	0.07	0.08
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0.09	0.09	0.09	0.10	0.10	0.10	0.11
<b>Temperature range III<sup>2)</sup>: 120°C / 72°C</b>									
Displacement	$\delta_{N0}$	[mm/(N/mm <sup>2</sup> )]	0.09	0.09	0.09	0.10	0.10	0.10	0.11
Displacement	$\delta_{N\infty}$	[mm/(N/mm <sup>2</sup> )]	0.13	0.13	0.14	0.14	0.14	0.15	0.16

1) Calculation of displacement under service load:  $\tau_{Sd}$  design value of bond stress

Displacement under short term loading =  $\delta_{N0} \cdot \tau_{Sd} / 1,4$

Displacement under long term loading =  $\delta_{N\infty} \cdot \tau_{Sd} / 1,4$

2) Explanation see chapter 1.2

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**Displacement under tension load**

**Rebar**

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**Table 13: Design method A, Characteristic shear load values**

HIT-HY 150 MAX with rebar			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25
<b>Steel failure without lever arm</b>									
Characteristic shear resistance for Rebar BSt 500 S acc. DIN 488 <sup>1)</sup>	$V_{Rk,s}$	[kN]	14	22	31	42	55	86	135
Partial safety factor for Rebar BSt 500 S acc. DIN 488 <sup>2)</sup>	$\gamma_{Ms,V}$ <sup>3)</sup>	[-]	1,5						
<b>Steel failure with lever arm</b>									
Characteristic bending resistance for Rebar BSt 500 S acc. DIN 488 <sup>4)</sup>	$M^0_{Rk,s}$	[Nm]	33	65	112	178	265	518	1012
Partial safety factor for Rebar BSt 500 S acc. DIN 488 <sup>2)</sup>	$\gamma_{Ms,V}$ <sup>3)</sup>	[-]	1,5						
<b>Concrete pryout failure</b>									
Factor in equation (5.7) of Technical Report TR 029 for the design of bonded anchors	k	[-]	2,0 for $h_{ef} \geq 60\text{mm}$						
Partial safety factor	$\gamma_{Mcp}$ <sup>3)</sup>	[-]	1,5 <sup>5)</sup>						
<b>Concrete edge failure <sup>6)</sup></b>									
Partial safety factor	$\gamma_{Mc}$ <sup>3)</sup>	[-]	1,5 <sup>5)</sup>						

- 1) Characteristic shear resistance  $V_{Rk,s}$  for rebars that do not fulfill the requirements acc. DIN 488 shall be calculated acc. Technical Report TR 029, Equation (5.5).
- 2) Partial safety factor  $\gamma_{Ms,V}$  for rebars that do not fulfill the requirements acc. DIN 488 shall be calculated acc. Technical Report TR 029, Equation (3.3b) or (3.3c).
- 3) In absence of national regulations
- 4) The characteristic bending resistance  $M^0_{Rk,s}$  for rebars that do not fulfil the requirements acc. DIN 488 shall be calculated acc. Technical Report TR 029, Equation (5.6b).
- 5) The partial safety factor  $\gamma_2 = 1,0$  is included.
- 6) Concrete edge failure see chapter 5.2.3.4 of Technical Report TR 029.

**Table 14: Displacement under shear load in mm/(N/mm<sup>2</sup>) <sup>1)</sup>**

HIT-HY 150 MAX with rebar			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25
Displacement	$\delta_{V0}$	[mm/kN]	0.06	0.05	0.05	0.04	0.04	0.04	0.03
Displacement	$\delta_{V\infty}$	[mm/kN]	0.09	0.08	0.07	0.06	0.06	0.05	0.05

- 1) Calculation of displacement under service load:  $V_{Sd}$  design value of shear stress  
 Displacement under short term loading =  $\delta_{N0} \cdot V_{Sd} / 1,4$   
 Displacement under long term loading =  $\delta_{N\infty} \cdot V_{Sd} / 1,4$

Regarding design of post-installed rebar as anchor see chapter 4.2.1.

**Injection System Hilti HIT-HY 150 MAX**

**Characteristic shear load values  
and displacement under shear load  
Rebar**

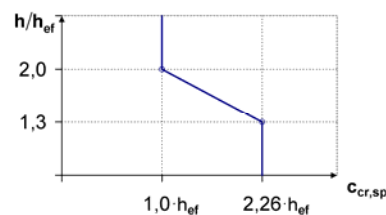
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**Table 15: Design method A, Characteristic tension load values**

HIT-HY 150 MAX with HIS-(R)N			M8	M10	M12	M16	M20	
<b>Steel failure HIS-N with screw strength class 8.8</b>								
Characteristic resistance	$N_{Rk,s}$	[kN]	25	46	67	118	109	
Partial safety factor	$\gamma_{Ms,N}^{1)}$	[-]	1,43	1,50		1,47		
<b>Steel failure HIS-RN with screw strength class 70</b>								
Characteristic resistance	$N_{Rk,s}$	[kN]	26	41	59	110	166	
Partial safety factor	$\gamma_{Ms,N}^{1)}$	[-]	1,87				2,4	
<b>Combined Pull-out and Concrete cone failure<sup>2)</sup></b>								
Effective anchorage depth	$h_{ef}$	[mm]	90	110	125	170	205	
Effective diameter of anchor	$d_1$	[mm]	12,5	16,5	20,5	25,4	27,6	
Characteristic bond resistance in non-cracked concrete C20/25								
Temperature range I <sup>3)</sup> : 40°C/24°C	$N_{Rk}^{4)}$	[kN]	35,0	50,0	75,0	95,0	115,0	
Temperature range II <sup>3)</sup> : 80°C/50°C	$N_{Rk}^{4)}$	[kN]	30,0	50,0	60,0	95,0	95,0	
Temperature range III <sup>3)</sup> : 120°C/72°C	$N_{Rk}^{4)}$	[kN]	20,0	30,0	40,0	60,0	60,0	
Increasing factor for $N_{Rk,p}$ in non cracked concrete	$\psi_c$	C30/37	1,04					
		C40/50	1,07					
		C50/60	1,09					
<b>Splitting failure<sup>2)</sup></b>								
Edge distance $c_{cr,sp}$ [mm] for	$h / h_{ef} \geq 2,0$		1,0 $h_{ef}$					
	$2,0 > h / h_{ef} > 1,3$		4,6 $h_{ef}$ - 1,8 h					
	$h / h_{ef} \leq 1,3$		2,26 $h_{ef}$					
Spacing	$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$					
Partial safety factor	$\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}^{1)}$	[-]	1,8 <sup>5)</sup>	1,8 <sup>5)</sup>	1,5 <sup>6)</sup>	1,5 <sup>6)</sup>	1,5 <sup>6)</sup>	



- 1) In absence of national regulations
- 2) Calculation of concrete failure and splitting see chapter 4.2.1.
- 3) Explanation see chapter 1.2
- 4) For design according TR029, the characteristic bond resistance may be calculated from the characteristic tension load values for combined pull-out and concrete cone failure according:  $\tau_{Rk} = N_{Rk}/(h_{ef} d_1 \pi)$ ;
- 5) The partial safety factor  $\gamma_2 = 1,2$  is included.
- 6) The partial safety factor  $\gamma_2 = 1,0$  is included.

**Table 16: Displacement under tension load in mm/10kN<sup>1)</sup>**

HIT-HY 150 MAX with HIS-(R)N		M8	M10	M12	M16	M20	
<b>Temperature range I<sup>2)</sup>: 40°C / 24°C</b>							
Displacement	$\delta_{N0}$	[mm/10kN]	0.03	0.04	0.06	0.12	0.17
Displacement	$\delta_{N\infty}$	[mm/10kN]	0.04	0.06	0.09	0.17	0.24
<b>Temperature range II<sup>2)</sup>: 80°C / 50°C</b>							
Displacement	$\delta_{N0}$	[mm/10kN]	0.03	0.04	0.06	0.12	0.16
Displacement	$\delta_{N\infty}$	[mm/10kN]	0.04	0.06	0.09	0.17	0.24
<b>Temperature range III<sup>2)</sup>: 120°C / 72°C</b>							
Displacement	$\delta_{N0}$	[mm/10kN]	0.04	0.06	0.09	0.17	0.24
Displacement	$\delta_{N\infty}$	[mm/10kN]	0.06	0.09	0.14	0.25	0.35

- 1) Calculation of displacement under service load:  $N_{Sd}$  design value of tension load  
Displacement under short term loading =  $\delta_{N0} \cdot N_{Sd}/10/1,4$ ; Displacement under long term loading =  $\delta_{N\infty} \cdot N_{Sd}/10/1,4$
- 2) Explanation see chapter 1.2

**Injection System Hilti HIT-HY 150 MAX**

**Characteristic tension load values  
and displacement under tension load  
Internal sleeve HIS-(R)N**

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**Table 17: Design method A, Characteristic shear load values**

HIT-HY 150 MAX with HIS-(R)N			M8	M10	M12	M16	M20
<b>Steel failure without lever arm</b>							
Characteristic resistance HIS-N screw class 8.8	$V_{Rk,s}$	[kN]	15	23	34	63	55
Partial safety factor	$\gamma_{Ms,V}^{2)}$	[-]	1,25				
Characteristic resistance HIS-RN screw class 70	$V_{Rk,s}$	[kN]	13	20	30	55	55
Partial safety factor	$\gamma_{Ms,V}^{2)}$	[-]	1,56				2,38
<b>Steel failure with lever arm</b>							
Characteristic resistance HIS-N screw class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519
Partial safety factor	$\gamma_{Ms,V}^{2)}$	[-]	1,25				
Characteristic resistance HIS-RN screw class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	233	454
Partial safety factor	$\gamma_{Ms,V}^{2)}$	[-]	1,56				
<b>Concrete pryout failure</b>							
Factor in equation (5.7) of Technical Report TR 029 for the design of bonded anchors	k	[-]	2,0				
Partial safety factor	$\gamma_{Mcp}^2)$	[-]	1,5 <sup>3)</sup>				
<b>Concrete edge failure see TR 029</b>							
Effective length of anchor in shear loading	$h_{ef}$	[mm]	90	110	125	170	205
Effective diameter of anchor	$d_1$	[mm]	12,5	16,5	20,5	25,4	27,6
Partial safety factor	$\gamma_{Mc}^{2)}$	[-]	1,5 <sup>3)</sup>				

- 1) Acc. chapter 4.2.2. fastening screws that fulfil the ductility requirement  $A_5 > 8\%$  (see Table 4) can be used only.
- 2) In absence of national regulations.
- 3) The partial safety factor  $\gamma_2 = 1,0$  is included.

**Table 18: Displacements under shear load in mm/kN<sup>1)</sup>**

HIT-HY 150 MAX with HIS-(R)N			M8	M10	M12	M16	M20
Displacement	$\delta_{V0}$	[mm/kN]	0,10	0,10	0,10	0,10	0,10
Displacement	$\delta_{V\infty}$	[mm/kN]	0,15	0,15	0,15	0,15	0,15

- 1) Calculation of displacement under service load;  $V_{Sd}$  design value of shear load  
 Displacement under short term loading =  $\delta_{V0} \cdot V_{Sd} / 1,4$ ;  
 Displacement under long term loading =  $\delta_{V\infty} \cdot V_{Sd} / 1,4$

**Injection System Hilti HIT-HY 150 MAX**

**Characteristic values to shear loads  
 Displacements under shear load  
 Internal sleeve HIS-(R)N**

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