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Autorisé et notifié conformément à l'article 10 de la directive 89/106/EEC du Conseil, du 21 décembre 1988, relative au rapprochement des dispositions législatives, réglementaires et administratives des Etats membres concernant les produits de construction.

CSTB
le futur en construction

MEMBRE DE L'EOTA

European Technical Approval ETA-08/0352

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

Nom commercial : **Trade name:**	**Injection system Hilti HIT-HY 150 MAX**
Titulaire : **Holder of approval:**	**Hilti Corporation Feldkircherstrasse 100 FL-9494 Schaan Principality of Liechtenstein**
Type générique et utilisation prévue du produit de construction : **Generic type and use of construction product:**	Cheville à scellement de type "à injection" pour fixation dans le béton fissuré M8 à M30. **Bonded injection type anchor for use in cracked concrete: sizes M8 to M30**
Validité du : au : **Validity from / to:**	**25/06/2013 25/06/2018**
Usine de fabrication : **Manufacturing plant:**	**Plant n°1**
Le présent Agrément technique européen contient : **This European Technical Approval contains:**	31 pages incluant 21 annexes faisant partie intégrante du document. **31 pages including 21 annexes which form an integral part of the document.**

Cet Agrément Technique Européen annule et remplace l'ATE-08/0352 valide du 01/04/2010 au 18/12/2013
This European Technical Approval cancels and replaces the ETA-08/0352 with validity from 01/04/2010 to 18/12/2013

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 [1], modified by the Council Directive 93/68/EEC of 22 July 1993 [2]; and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council [3];
   - Décret n° 92-647 du 8 juillet 1992 [4] regarding the fitness for use of construction products;
   - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC [5];
   - 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 fitness 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.

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 Official Journal of the European Union L 284, 31 October 2003, p. 25
4 Journal officiel de la République française du 14 juillet 1992
5 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), reinforcing bar, stainless steel (HIT-V-R, HAS-(E)R, HIS-RN, HZA-R), 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 cracked or non-cracked concrete.

The elements made of zinc plated carbon steel (Threaded rods HIT-V, HAS-(E), 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, internal sleeves HIS-RN and tension anchor HZA-R) 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 [6] of this European Technical Approval. The characteristic anchor values for the design of anchorages are provided in Annexes 11 to 21.

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 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.

Each Tension anchor made of stainless steel is marked with “HZA-R”, the thread size and maximum thickness of fixture according to Annex 5.

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 1.

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.

[6] 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

3.2.1.1 Factory production control

The manufacturer shall have a factory production control system in the plant and shall exercise 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 [7]. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of incoming materials shall include control of the inspection documents presented by suppliers.

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 product.

The results of factory production control are recorded and evaluated.

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.

3.2.1.2 Other tasks of the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved. The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

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.

7 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.

3.2.2.2 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.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval.

3.2.2.3 Continuous surveillance

The approved certification body involved by the manufacturer 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 and CSTB informed without delay.

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:

- Commercial name;
- Name or identifying mark of the producer and manufacturing plant;
- Name of approval body and ETA number;
- Identification number of the certification body;
- Number of the EC certificate of conformity;
- Use category (ETAG 001-5, option 1)
- The last two digits of the year in which the CE-marking was affixed;
- 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. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to the Centre Scientifique et Technique du Bâtiment before the changes are introduced. The Centre Scientifique et Technique du Bâtiment will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

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 [8] "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 HIS-N only fastening screws or threaded rods made of galvanised steel with the minimum strength class 8.8 EN ISO 898-1 shall be used. For the internal sleeve HIS-RN only fastening screws or threaded rods made of stainless steel with the minimum strength class A4-70 EN ISO3506-1 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;
– commercial standard threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled:

[8] The Technical Report TR 029 "Design of Bonded Anchors" is published in English on EOTA website www.eota.eu.

- material, dimensions and mechanical properties of the metal parts according to the specifications given in Annex 6, Table 5,
- confirmation of material and mechanical properties of the metal parts by inspection certificate 3.1 according to EN 10204:2004, the documents should be stored,
- marking of the threaded rod with the envisage embedment depth. This may be done by the manufacturer of the rod or the person on jobsite.

– 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;
– 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 7 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 during the curing time, e.g. with wedges,
– for injection of the mortar in bore holes ≥ 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 trigger pulls of mortar of each new foil pack 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°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 as well as in sections 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 5,
– 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 foil packs 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.

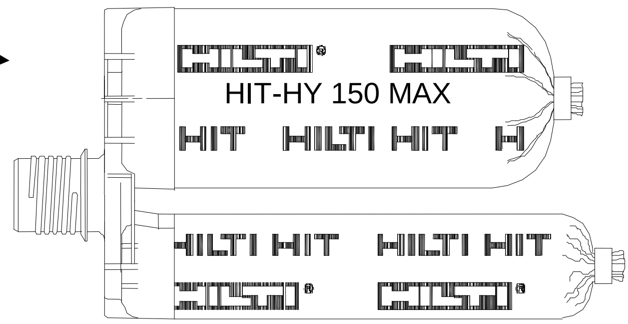
The original French version is signed by

Le Directeur Technique
C. BALOCHE

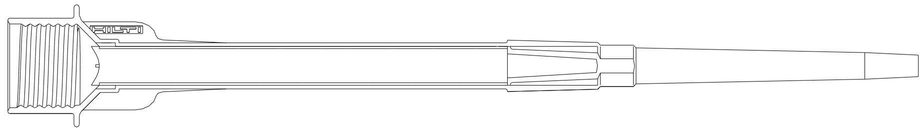
Injection mortar: hybrid system with resin, hardener and cement water component

Foil pack 330ml, 500ml and 1400ml

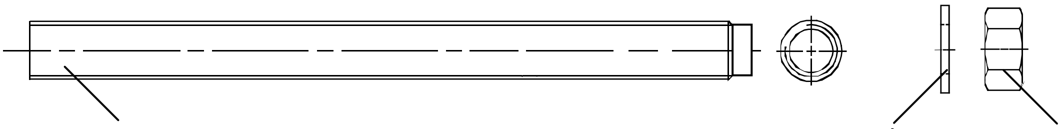
Marking
HILTI HIT
HY 150 MAX
production date
expiration date



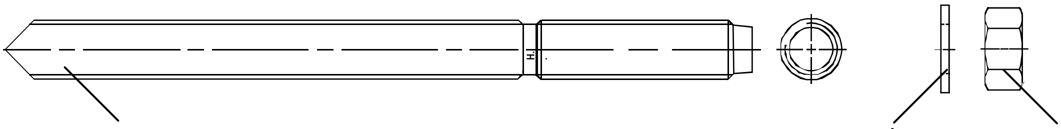
Static Mixer HIT-RE-M



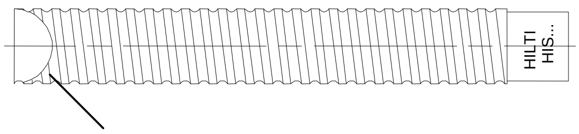
Steel elements:



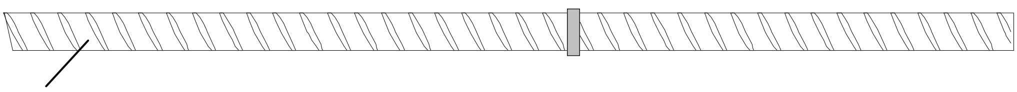
Threaded rod HIT-V ... washer nut
thread sizes M8, M10, M12, M16, M20, M24, M27 or M30



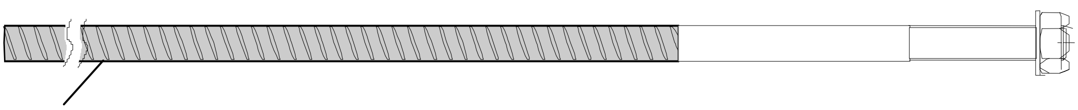
Threaded rod HAS-(E) ... washer nut
thread sizes M8, M10, M12, M16, M20, M24, M27 or M30



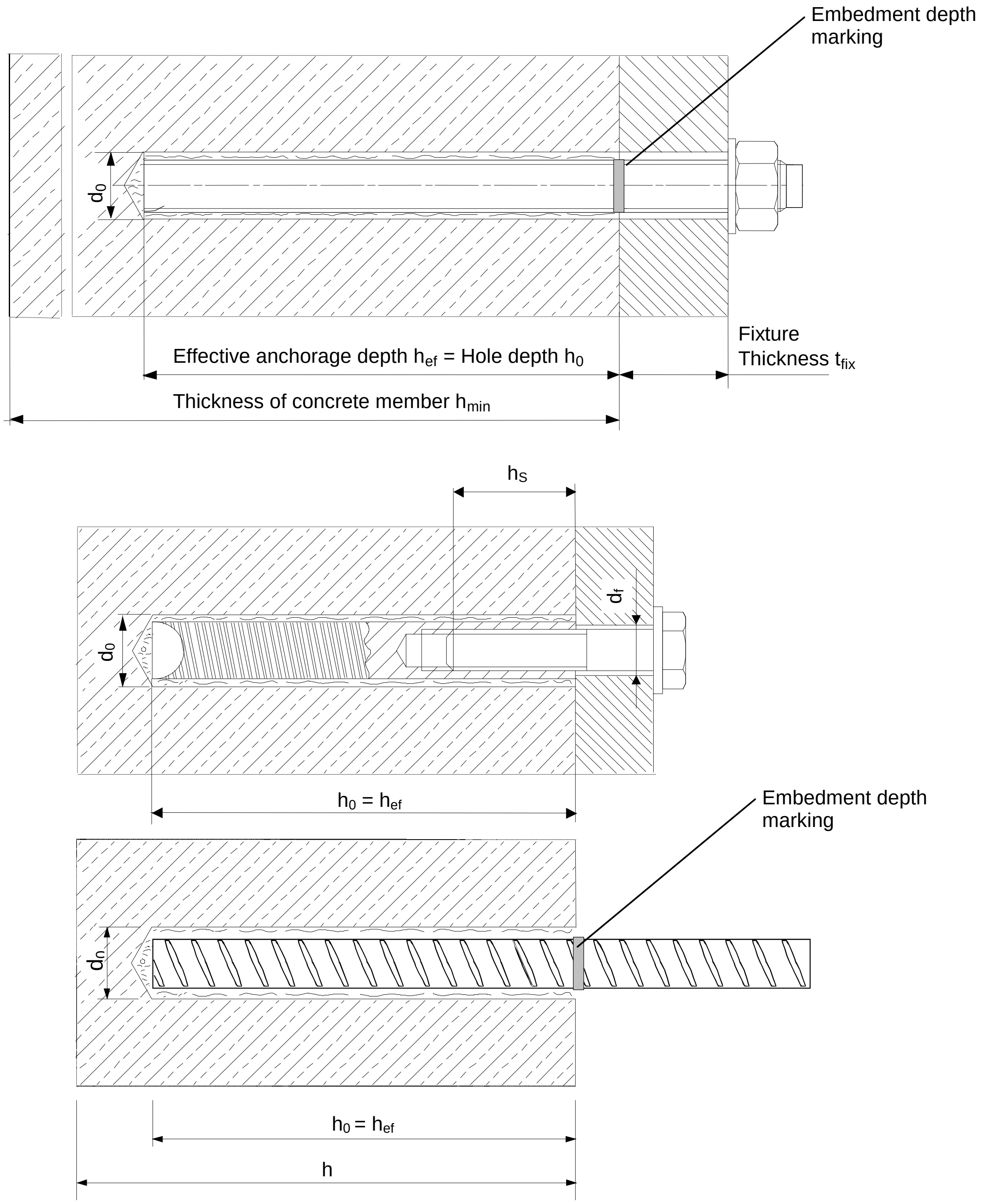
Internal sleeve HIS-(R)N …
thread sizes M8, M10, M12, M16 or M20



Rebar
diameter ø8, ø10, ø12, ø14, ø16, ø20 or ø25



Hilti Tension anchor HZA-R M12, M16, M20 or M24



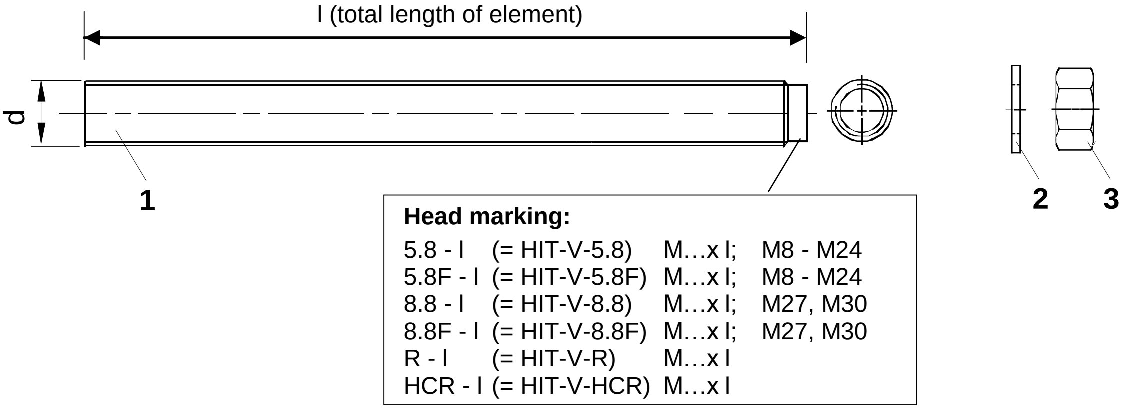
Use category:	**Installation in dry or water saturated concrete, (not in flooded holes)**	
Temperature range I:	- 40°C to + 40°C	(max long term temperature + 24°C and max short term temperature + 40°C)
Temperature range II:	- 40°C to + 80°C	(max long term temperature + 50°C and max short term temperature + 80°C)
Temperature range III:	- 40°C to + 120°C	(max long term temperature + 72°C and max short term temperature + 120°C)

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 **HIT-V-...**	min	[mm]	60	60	70	80	90	100	110	120
	max	[mm]	160	200	240	320	400	480	540	600
Effective anchorage depth **HAS-(E)...**	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 [1)]	d_f P	[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 mm ≥ 100 mm			$h_{ef} + 2d_o$				
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

[1)] For larger diameter of clearance hole see chapter 1.1 of TR 029

HIT-V…



HAS-(E)…

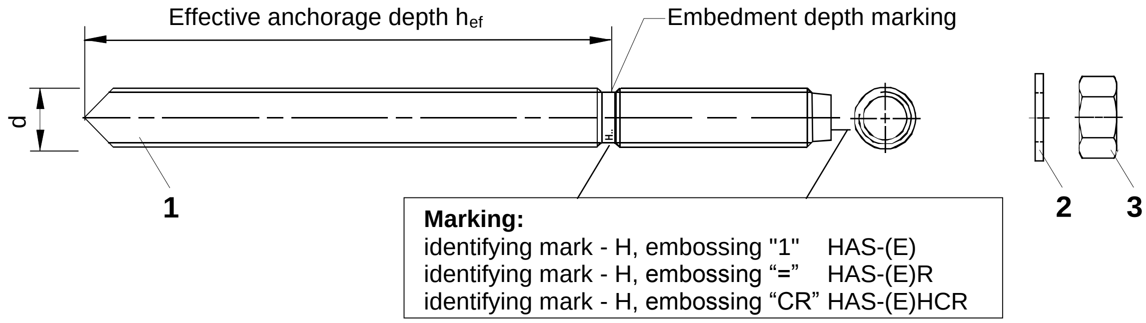


Table 2: Installation parameters of internal sleeve HIS-(R)N

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…

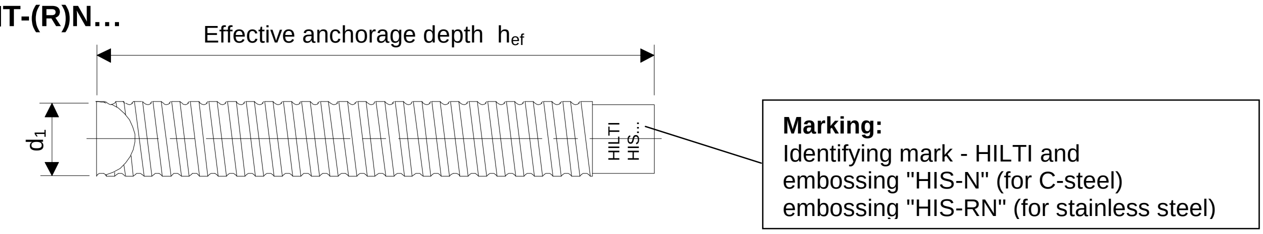
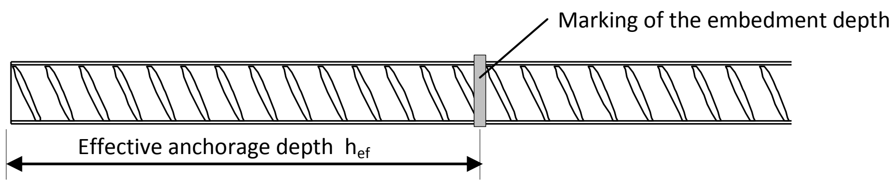


Table 3: Installation parameters of anchor element rebar

HIT-HY 150 MAX with 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 1)	12-14 1)	14-16 1)	18	20	25	32
Minimum thickness of concrete member	h_{min}	[mm]	h_{ef} + 30mm ≥ 100 mm			$h_{ef} + 2d_o$			
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 $k = (f_t/f_y)_k$		≥ 1,08	≥ 1,15 < 1,35
Characteristic strain at maximum force, ε_{uk} (%)		≥ 5,0	≥ 7,5
Bendability		Bend/Rebend test	
Maximum deviation from nominal mass (individual bar) (%)	Nominal bar size (mm) ≤ 8 > 8	± 6,0 ± 4,5	
Bond: Minimum relative rib area, $f_{R,min}$ (determination according to EN 15630)	Nominal bar size (mm) 8 to 12 > 12	0,040 0,056	

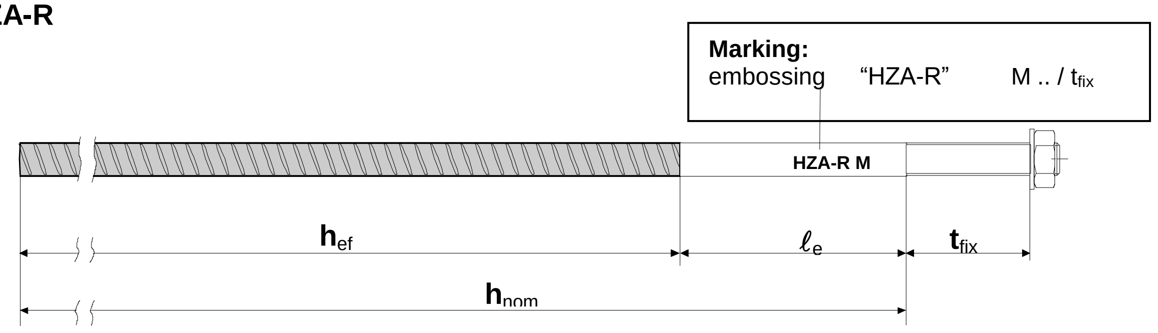
Height of the rebar rib h_{rib}:

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

Table 4: Installation parameters of Hilti tension anchor HZA-R

HIT-HY 150 MAX with HZA-R			M12	M16	M20	M24
Diameter of reinforcement bar	d	[mm]	12	16	20	25
Range of embedment (h_{nom}) and drill hole depth (h_0)	min	[mm]	170	180	190	200
	max	[mm]	240	320	400	500
Bond length	h_{ef}	[mm]	h_{nom} -100			
Length of smooth shaft	ℓ_e	[mm]	100			
Nominal diameter of drill bit	d_0	[mm]	16	20	25	32
Diameter of clearance hole in the fixture	d_f	[mm]	14	18	22	26
Max. torque moment	T_{max}	[mm]	40	80	150	200
Minimum thickness of concrete member	h_{min}	[mm]	$h_{nom} + 2d_o$			
Minimum spacing	s_{min}	[mm]	60	80	100	120
Minimum edge distance	c_{min}	[mm]	60	80	100	120

HZA-R



Injection System Hilti HIT-HY 150 MAX	Annex 5
Installation parameters rebar	of European Technical Approval **ETA – 08/0352**

Table 5: Materials

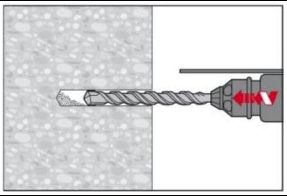
Designation	Material
Metal parts made of rebar	
Rebar	See Annex 5
Metal parts made of zinc coated steel	
threaded rod HIT-V-5.8(F) HAS-(E) M8 to M24	strength class 5.8 EN ISO 898-1, A5 > 8% Ductile steel galvanized ≥ 5µm EN ISO 4042 (F) hot dipped galvanized ≥ 45µm EN ISO 10684
threaded rod HIT-V-8.8(F) HAS-(E) M27 and M30	strength class 8.8 EN ISO 898-1, A5 > 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[1)] HIS-N	C-Stahl 1.0718, EN 10277-3 steel galvanized ≥ 5µm EN ISO 4042
Metal parts made of stainless steel	
threaded rod HIT-V-R HAS-(E)R	for ≤ M24: strength class 70 EN ISO 3506-1; A5 > 8% Ductile for > M24: strength class 50 EN ISO 3506-1; A5 > 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[2)] HIS-RN	stainless steel 1.4401 und 1.4571 EN 10088
Hilti tension anchor HZA-R	Round steel smooth with thread: stainless steel 1.4404, 1.4571 and 1.4362 EN 10088 Rebar B500-A acc. DIN 488-1:2009 and DIN 488-2:2009
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
Metal parts made of high corrosion resistant steel	
threaded rod HIT-V-HCR HAS-(E)HCR	for ≤ M20: R_m = 800 N/mm²; $R_{p\,0,2}$ = 640 N/mm², A_5 > 8% Ductile for > M20: R_m = 700 N/mm²; $R_{p\,0,2}$ = 400 N/mm², A_5 > 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_5 > 8% Ductile
steel galvanized ≥ 5µm EN ISO 4042

2) related fastening screw: strength class 70 EN ISO 3506-1, A_5 > 8% Ductile
stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088

Instruction for use

Bore hole drilling

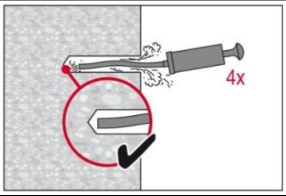


Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

Bore hole cleaning

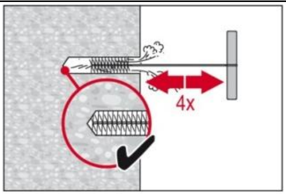
Just before setting an anchor, the bore hole must be free of dust and debris.

a) Manual cleaning (MC) for bore hole diameters $d_0 \leq 18$ mm and bore hole depth $h_0 \leq 10d$ and **non-cracked concrete** only

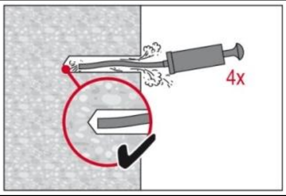


The Hilti manual pump may be used for blowing out bore holes up to diameters $d_0 \leq 18$ mm and embedment depths up to $h_{ef} \leq 10d$.

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

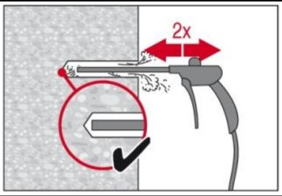


Brush 4 times with the specified brush size (brush Ø ≥ bore hole Ø, see Table 7) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the bore hole. If not, the brush is too small and must be replaced with the proper brush diameter.

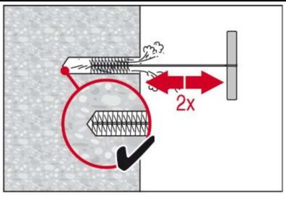


Blow out again with manual pump at least 4 times until return air stream is free of noticeable dust.

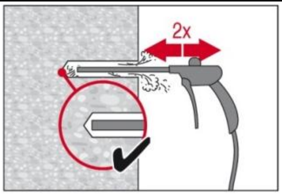
b) Compressed air cleaning (CAC) for all bore hole diameters d_0 and all bore hole depth h_0 and for **cracked and non-cracked concrete**



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.

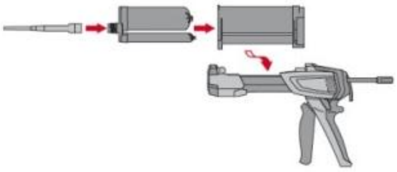


Brush 2 times with the specified brush size (brush Ø ≥ bore hole Ø, see Table 7) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the bore hole. If not, the brush is too small and must be replaced with the proper brush diameter.

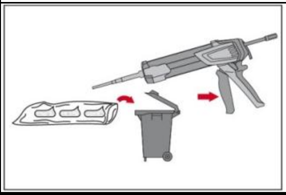


Blow again with compressed air 2 times until return air stream is free of noticeable dust.

Injection preparation



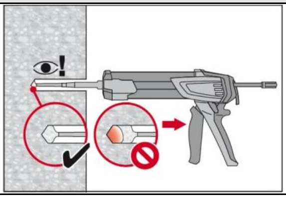
Tightly attach new Hilti mixing nozzle HIT-RE-M to foil pack manifold (snug fit). Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser.
Check foil pack holder for proper function. Do not use damaged foil packs / holders.
Swing foil pack holder with foil pack into HIT-dispenser.



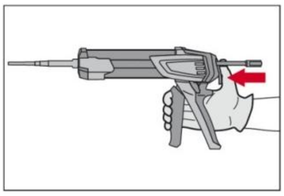
Discard initial adhesive. The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.

Discard quantities are	2 strokes	for 330 ml foil pack,
	3 strokes	for 500 ml foil pack,
	45 ml	for 1400 ml foil pack

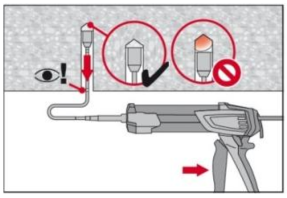
Inject adhesive from the back of the borehole without forming air voids



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.

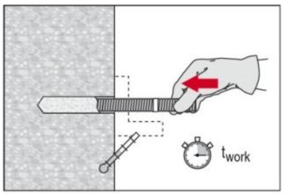


Overhead installation and installation with embedment depth h_{ef} > 250mm

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 7).

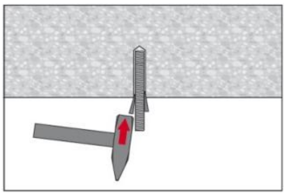
Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the bore hole by the adhesive pressure.

Setting the element

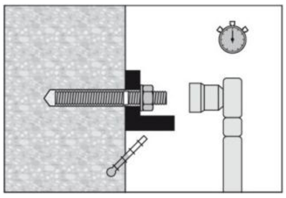


Before use, verify that the element is dry and free of oil and other contaminants.

Mark and set element to the required embedment depth till working time t_{work} has elapsed. The working time t_{work} is given in Table 6.



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



Loading the anchor:
After required curing time t_{cure} (see Table 6) the anchor can be loaded.
The applied installation torque shall not exceed the values T_{max} given in Table 1, Table 2 and Table 4.

Table 6: Working time, curing time

Base material temperature	Working time "t_{work}"	Curing time "t_{cure}"
-10 °C ≤ $T_{base\ material}$ < -5°C [1)]	180 min	12 h
-5 °C ≤ $T_{base\ material}$ < 0°C	40 min	4 h
0 °C ≤ $T_{base\ material}$ < 5°C	20 min	2 h
5 °C ≤ $T_{base\ material}$ < 20°C	8 min	1 h
20 °C ≤ $T_{base\ material}$ < 30°C	5 min	30 min
30 °C ≤ $T_{base\ material}$ ≤ 40°C	2 min	30 min

[1)] The foil pack temperature must be between 20°C and 25°C

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

Manual Cleaning (MC):
Hilti hand pump recommended for blowing out bore holes with diameters d_0≤18 mm and bore hole depth h_0≤10d

Table 7: Bore hole cleaning: Steel brush – Installation with Piston Plug

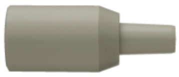
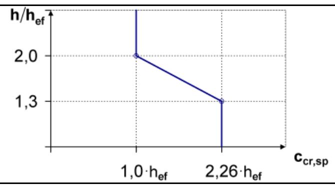
Element	Size	Nominal drill bit diameter d_0 [mm]	Steel brush HIT-RB	Piston plug HIT-SZ	Cleaning methods (see Annex 9)	
					**Manual cleaning (MC)** non-cracked concrete only	**Compressed air cleaning (CAC)** cracked and non-cracked concrete
HIT-V / HAS	M8	10	HIT-RB 10	-	Yes ... $h_{ef} \leq$ 80mm	Yes
	M10	12	HIT-RB 12	HIT-SZ 12	Yes ... $h_{ef} \leq$ 100mm	Yes
	M12	14	HIT-RB 14	HIT-SZ 14	Yes ... $h_{ef} \leq$ 120mm	Yes
	M16	18	HIT-RB 18	HIT-SZ 18	Yes ... $h_{ef} \leq$ 160mm	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
HIS-(R)N	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
Rebar	Ø8	10 to 12	HIT-RB 10 to 12	HIT-SZ 10 to 12	Yes ... $h_{ef} \leq$ 80mm	Yes
	Ø10	12 to 14	HIT-RB 12 to 14	HIT-SZ 12 to 14	Yes ... $h_{ef} \leq$ 100mm	Yes
	Ø12	14 to16	HIT-RB 14 to 16	HIT-SZ 14 to 16	Yes ... $h_{ef} \leq$ 120mm	Yes
	Ø14	18	HIT-RB 18	HIT-SZ 18	Yes ... $h_{ef} \leq$ 140mm	Yes
	Ø16	20	HIT-RB 20	HIT-SZ 20	No	Yes
	Ø20	25	HIT-RB 25	HIT-SZ 25	No	Yes
	Ø25	32	HIT-RB 32	HIT-SZ 32	No	Yes
HZA-R	M12	16	HIT-RB 16	HIT-SZ 16	No	Yes
	M16	20	HIT-RB 20	HIT-SZ 20	No	Yes
	M20	25	HIT-RB 25	HIT-SZ 25	No	Yes
	M24	32	HIT-RB 32	HIT-SZ 32	No	Yes

Table 8: 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
Steel failure HIT-V-…										
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		
Steel failure HAS(-E)…										
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		
Combined Pull-out and Concrete cone failure [2]										
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 [3]: **40°C / 24°C**	$\tau_{Rk,ucr}$	[N/mm²]	**14,0**	**14,0**	**14,0**	**13,0**	**12,0**	**11,0**	**10,0**	**8,5**
Temperature range II [3]: **80°C / 50°C**	$\tau_{Rk,ucr}$	[N/mm²]	**12,0**	**12,0**	**12,0**	**12,0**	**11,0**	**10,0**	**9,0**	**7,0**
Temperature range III [3]: **120°C / 72°C**	$\tau_{Rk,ucr}$	[N/mm²]	**8,0**	**8,0**	**8,0**	**7,0**	**6,5**	**6,0**	**5,5**	**4,5**
Partial safety factor	$\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1]	[-]	1,8 [4]	1,8 [4]	1,8 [4]	1,5 [5]	1,5 [5]	1,5 [5]	1,5 [5]	1,8 [4]
Characteristic bond resistance in cracked concrete C20/25										
Temperature range I [3]: **40°C / 24°C**	$\tau_{Rk,cr}$	[N/mm²]	**n.a.**	**5,5**	**5,5**	**6,0**	**6,0**	**6,0**	**n.a.**	**n.a.**
Temperature range II [3]: **80°C / 50°C**	$\tau_{Rk,cr}$	[N/mm²]	**n.a.**	**4,5**	**5,0**	**5,5**	**6,0**	**6,0**	**n.a.**	**n.a.**
Temperature range III [3]: **120°C / 72°C**	$\tau_{Rk,cr}$	[N/mm²]	**n.a.**	**3,0**	**3,0**	**3,5**	**3,5**	**4,0**	**n.a.**	**n.a.**
Partial safety factor	$\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1]	[-]	-	1,5 [5]	1,5 [5]	1,5 [5]	1,5 [5]	1,5 [5]	-	-
Increasing factor for $\tau_{Rk,p}$ in cracked and non cracked concrete	ψ_c	C30/37	1,04							
		C40/50	1,07							
		C50/60	1,09							
Splitting failure [2]										
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 $c_{cr,sp}$							



[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 γ_2 = 1,2 is included.
[5] The partial safety factor γ_2 = 1,0 is included.

Table 9: Displacement under tension load in mm/(N/mm²) [1)]

HIT-HY 150 MAX with HIT-V-… / HAS(-E)-…			M8	M10	M12	M16	M20	M24	M27	M30
Non cracked concrete temperature range I [2)]: 40°C / 24°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,06	0,06	0,06	0,07	0,07	0,07	0,08	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,09	0,09	0,09	0,10	0,10	0,11	0,11	0,12
Non cracked concrete temperature range II [2)]: 80°C / 50°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,06	0,06	0,06	0,07	0,07	0,07	0,08	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,09	0,09	0,09	0,10	0,10	0,11	0,11	0,12
Non cracked concrete temperature range III [2)]: 120°C / 72°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,09	0,09	0,09	0,10	0,10	0,11	0,11	0,12
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,13	0,13	0,14	0,14	0,15	0,16	0,17	0,17
Cracked concrete temperature range I [2)]: 40°C / 24°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	-	0,09	0,10	0,11	0,13	0,15	-	-
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	-	0,09	0,10	0,11	0,13	0,15	-	-
Cracked concrete temperature range II [2)]: 80°C / 50°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	-	0,09	0,10	0,12	0,14	0,16	-	-
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	-	0,09	0,10	0,12	0,14	0,16	-	-
Cracked concrete temperature range III [2)]: 120°C / 72°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	-	0,14	0,15	0,18	0,20	0,23	-	-
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	-	0,14	0,15	0,18	0,20	0,23	-	-

[1)] Calculation of displacement under service load: τ_{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

Table 10: Design method A, Characteristic shear load values

HIT-HY 150 MAX with HIT-V-… / HAS(-E)-…			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure [1] without lever arm										
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
Steel failure [1] with lever arm										
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
Partial safety factor steel failure										
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		
Concrete pryout failure										
Factor in equation (5.7) of Technical Report TR 029 for the design of bonded anchors	k	[-]	2,0 for $h_{ef} \geq 60$mm							
Partial safety factor	γ_{Mcp} [2]	[-]	1,5 [3]							
Concrete edge failure [4]										
Partial safety factor	γ_{Mc} [2]	[-]	1,5 [3]							

[1] Acc. chapter 4.2.2. commercial standard rods that fulfill the ductility requirement A5>8% (see Table 4) can be used only.
[2] In absence of national regulations.
[3] The partial safety factor γ_2 = 1,0 is included.
[4] Concrete edge failure see chapter 5.2.3.4 of Technical Report TR 029.

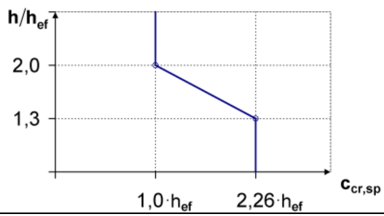
Table 11: Displacement under shear load in mm/kN [1]

HIT-HY 150 MAX with HIT-V-… / HAS(-E)-…			M8	M10	M12	M16	M20	M24	M27	M30
Displacement	δ_{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 load
Displacement under short term loading = $\delta_{V0} \cdot V_{Sd}/1,4$
Displacement under long term loading = $\delta_{V\infty} \cdot V_{Sd}/1,4$

Table 12: Design method A, Characteristic tension load values

HIT-HY 150 MAX with rebar			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25
Steel failure rebar									
Characteristic tension resistance for Rebar BSt 500 S acc. DIN 488 [1]	$N_{Rk,s}$	[kN]	**28**	**43**	**62**	**85**	**111**	**173**	**270**
Partial safety factor for Rebar BSt 500 S acc. DIN 488 [2]	$\gamma_{Ms,N}$ [3]	[-]	1,4						
Combined Pull-out and Concrete cone failure [4]									
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 [5]: **40°C/24°C**	$\tau_{Rk,ucr}$	[N/mm²]	**9,5**	**9,5**	**9,5**	**9,5**	**9,5**	**9,5**	**9,5**
Temperature range II [5]: **80°C/50°C**	$\tau_{Rk,ucr}$	[N/mm²]	**8,0**	**8,0**	**8,0**	**8,0**	**8,0**	**8,0**	**8,0**
Temperature range III [5]: **120°C/72°C**	$\tau_{Rk,ucr}$	[N/mm²]	**5,0**	**5,0**	**5,0**	**5,0**	**5,0**	**5,0**	**5,0**
Partial safety factor	$\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [3]	[-]	1,8 [6]	1,8 [6]	1,8 [6]	1,8 [6]	1,5 [7]	1,5 [7]	1,8 [6]
Characteristic bond resistance in cracked concrete C20/25									
Temperature range I [5] **40°C/24°C**	$\tau_{Rk,cr}$	[N/mm²]	**n.a.**	**5,5**	**5,5**	**6,0**	**6,0**	**6,0**	**6,0**
Temperature range II [5]: **80°C/50°C**	$\tau_{Rk,cr}$	[N/mm²]	**n.a.**	**4,5**	**5,0**	**5,0**	**5,5**	**6,0**	**6,0**
Temperature range III [5]: **120°C/72°C**	$\tau_{Rk,cr}$	[N/mm²]	**n.a.**	**3,0**	**3,0**	**3,5**	**3,5**	**3,5**	**4,0**
Partial safety factor	$\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [3]	[-]	-	1,5 [7]	1,5 [7]	1,5 [7]	1,5 [7]	1,5 [7]	1,8 [6]
Increasing factor for $\tau_{Rk,p}$ in cracked and non cracked concrete	ψ_c	C30/37	1,04						
		C40/50	1,07						
		C50/60	1,09						
Splitting failure [4]									
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 $c_{cr,sp}$						



[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 γ_2 = 1,2 is included.
[7] The partial safety factor γ_2 = 1,0 is included.

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

Table 13: Displacement under tension load in mm/(N/mm²) [1)]

HIT-HY 150 MAX with rebar			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25
Non-cracked concrete temperature range I [2)]: 40°C / 24°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	0,06	0,06	0,06	0,07	0,07	0,07	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,09	0,09	0,09	0,10	0,10	0,10	0,11
Non-cracked concrete temperature range II [2)]: 80°C / 50°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	0,06	0,06	0,06	0,07	0,07	0,07	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,09	0,09	0,09	0,10	0,10	0,10	0,11
Non-cracked concrete temperature range III [2)]: 120°C / 72°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	0,09	0,09	0,09	0,10	0,10	0,10	0,11
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,13	0,13	0,14	0,14	0,14	0,15	0,16
Cracked concrete temperature range I [2)]: 40°C / 24°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	-	0,09	0,10	0,11	0,11	0,13	0,15
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	-	0,09	0,10	0,11	0,11	0,13	0,15
Cracked concrete temperature range II [2)]: 80°C / 50°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	-	0,09	0,10	0,11	0,12	0,14	0,16
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	-	0,09	0,10	0,11	0,12	0,14	0,16
Cracked concrete temperature range III [2)]: 120°C / 72°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	-	0,14	0,15	0,16	0,18	0,20	0,23
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	-	0,14	0,15	0,16	0,18	0,20	0,23

[1)] Calculation of displacement under service load: τ_{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

Table 14: Design method A, Characteristic shear load values

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

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 γ_2 = 1,0 is included.
6) Concrete edge failure see chapter 5.2.3.4 of Technical Report TR 029.

Table 15: Displacement under shear load in mm/kN [1)]

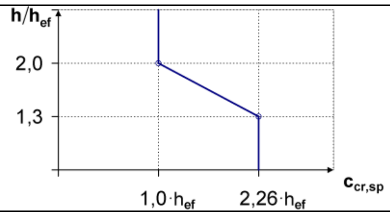
HIT-HY 150 MAX with rebar			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25
Displacement	δ_{V0}	[mm/kN]	0,06	0,05	0,05	0,04	0,04	0,04	0,03
Displacement	$\delta_{V\infty}$	[mm/kN]	0,09	0,08	0,07	0,06	0,06	0,05	0,05

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

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

Table 16: Design method A, Characteristic tension load values

HIT-HY 150 MAX with HIS-(R)N			M8	M10	M12	M16	M20
Steel failure HIS-N with screw strength class 8.8							
Characteristic resistance	$N_{Rk,s}$	[kN]	**25**	**46**	**67**	**118**	**109**
Partial safety factor	$\gamma_{Ms,N}$ [1)]	[-]	1,43	1,50		1,47	
Steel failure HIS-RN with screw strength class 70							
Characteristic resistance	$N_{Rk,s}$	[kN]	**26**	**41**	**59**	**110**	**166**
Partial safety factor	$\gamma_{Ms,N}$ [1)]	[-]	1,87				2,4
Combined Pull-out and Concrete cone failure [2)]							
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 resistance in non-cracked concrete C20/25							
Temperature range I [3)]: **40°C/24°C**	$N_{Rk,ucr}$ [4)]	[kN]	**35,0**	**50,0**	**75,0**	**95,0**	**115,0**
Temperature range II [3)]: **80°C/50°C**	$N_{Rk,ucr}$ [4)]	[kN]	**30,0**	**50,0**	**60,0**	**95,0**	**95,0**
Temperature range III [3)]: **120°C/72°C**	$N_{Rk,ucr}$ [4)]	[kN]	**20,0**	**30,0**	**40,0**	**60,0**	**60,0**
Increasing factor for $N_{Rk,p}$ in cracked and non cracked concrete	ψ_c	C30/37	1,04				
		C40/50	1,07				
		C50/60	1,09				
Splitting failure [2)]							
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 [5)]	1,8 [5)]	1,5 [6)]	1,5 [6)]	1,5 [6)]



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: $\tau_{Rk} = N_{Rk}/(h_{ef} \cdot d_1 \cdot \pi)$
5) The partial safety factor γ_2 = 1,2 is included.
6) The partial safety factor γ_2 = 1,0 is included.

Table 17: Displacement under tension load in mm/10kN [1)]

HIT-HY 150 MAX with HIS-(R)N			M8	M10	M12	M16	M20
Temperature range I [2)]**: 40°C / 24°C**							
Displacement	δ_{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
Temperature range II [2)]**: 80°C / 50°C**							
Displacement	δ_{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
Temperature range III [2)]**: 120°C / 72°C**							
Displacement	δ_{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 bond stress
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

Table 18: Design method A, Characteristic shear load values

HIT-HY 150 MAX with HIS-(R)N			M8	M10	M12	M16	M20
Steel failure [1] without lever arm							
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
Steel failure [1] with lever arm							
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				
Concrete pryout failure							
Factor in equation (5.7) of Technical Report TR 029 for the design of bonded anchors	k	[-]	2,0				
Partial safety factor	γ_{Mcp} [2]	[-]	1,5 [3]				
Concrete edge failure see TR 029							
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	γ_{Mc} [2]	[-]	1,5 [3]				

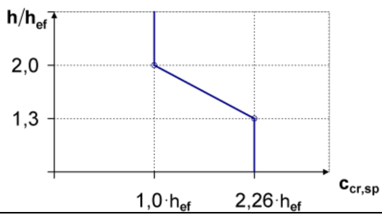
[1] Acc. chapter 4.2.2. fastening screws that fulfil the ductility requirement A_5>8% (see Table 4) can be used only.
[2] In absence of national regulations.
[3] The partial safety factor γ_2 = 1,0 is included.

Table 19: Displacements under shear load in mm/kN [1]

HIT-HY 150 MAX with HIS-(R)N			M8	M10	M12	M16	M20
Displacement	δ_{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 = $\delta_{V\infty} \cdot V_{Sd}/1,4$

Table 20: Design method A, Characteristic tension load values

HIT-HY 150 MAX with HZA-R			M12	M16	M20	M24
Steel failure rebar						
Characteristic tension resistance for HZA-R	$N_{Rk,s}$	[kN]	**62**	**111**	**173**	**248**
Partial safety factor	$\gamma_{Ms,N}$ 1)	[-]	1,4			
Combined Pull-out and Concrete cone failure 2)						
Diameter of HZA-R	d	[mm]	12	16	20	25
Characteristic bond resistance in non-cracked concrete C20/25						
Temperature range I 3): **40°C/24°C**	$\tau_{Rk,ucr}$	[N/mm²]	**9,5**	**9,5**	**9,5**	**9,5**
Temperature range II 3): **80°C/50°C**	$\tau_{Rk,ucr}$	[N/mm²]	**8,0**	**8,0**	**8,0**	**8,0**
Temperature range III 3): **120°C/72°C**	$\tau_{Rk,ucr}$	[N/mm²]	**5,0**	**5,0**	**5,0**	**5,0**
Partial safety factor	$\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ 1)	[-]	1,8 4)	1,5 5)	1,5 5)	1,8 4)
Characteristic bond resistance in cracked concrete C20/25						
Temperature range I 3) **40°C/24°C**	$\tau_{Rk,cr}$	[N/mm²]	**5,5**	**6,0**	**6,0**	**6,0**
Temperature range II 3): **80°C/50°C**	$\tau_{Rk,cr}$	[N/mm²]	**5,0**	**5,5**	**6,0**	**6,0**
Temperature range III 3): **120°C/72°C**	$\tau_{Rk,cr}$	[N/mm²]	**3,0**	**3,5**	**3,5**	**4,0**
Partial safety factor	$\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ 1)	[-]	1,5 5)	1,5 5)	1,5 5)	1,8 4)
Increasing factor for $\tau_{Rk,p}$ in cracked and non-cracked concrete	ψ_c	C30/37	1,04			
		C40/50	1,07			
		C50/60	1,09			
Splitting failure 2)						
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 $c_{cr,sp}$			

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 γ_2 = 1,2 is included.
5) The partial safety factor γ_2 = 1,0 is included.

Injection System Hilti HIT-HY 150 MAX	Annex 19
Characteristic tension load values HZA-R	of European Technical Approval **ETA – 08/0352**

Table 21: Displacement under tension load in mm/(N/mm²) [1)]

HIT-HY 150 MAX with HZA-R			M12	M16	M20	M24
Non-cracked concrete temperature range I [2)]: 40°C / 24°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,06	0,07	0,07	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,09	0,10	0,10	0,11
Non-cracked concrete temperature range II [2)]: 80°C / 50°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,06	0,07	0,07	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,09	0,10	0,10	0,11
Non-cracked concrete temperature range III [2)]: 120°C / 72°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,09	0,10	0,10	0,11
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,14	0,14	0,15	0,16
Cracked concrete temperature range I [2)]: 40°C / 24°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,10	0,11	0,13	0,15
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,10	0,11	0,13	0,15
Cracked concrete temperature range II [2)]: 80°C / 50°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,10	0,12	0,14	0,16
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,10	0,12	0,14	0,16
Cracked concrete temperature range III [2)]: 120°C / 72°C						
Displacement	δ_{N0}	[mm/(N/mm²)]	0,15	0,18	0,20	0,23
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,15	0,18	0,20	0,23

[1)] Calculation of displacement under service load: τ_{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

Table 22: Design method A, Characteristic shear load values

HIT-HY 150 MAX with HZA-R			M12	M16	M20	M24
Steel failure without lever arm						
Characteristic shear resistance for HZA-R	$V_{Rk,s}$	[kN]	**31**	**55**	**86**	**124**
Partial safety factor for HZA-R	$\gamma_{Ms,V}$ [1]	[-]	1,5 [2]			
Steel failure with lever arm						
Characteristic bending resistance for HZA-R	$M^0_{Rk,s}$	[Nm]	**97**	**234**	**457**	**790**
Partial safety factor for HZA-R	$\gamma_{Ms,V}$ [1]	[-]	1,5 [2]			
Concrete pryout failure						
Factor in equation (5.7) of Technical Report TR 029 for the design of bonded anchors	k	[-]	2,0 for $h_{ef} \geq 60$mm			
Partial safety factor	γ_{Mcp} [1]	[-]	1,5 [2]			
Concrete edge failure [3]						
Partial safety factor	γ_{Mc} [1]	[-]	1,5 [2]			

[1] In absence of national regulations.
[2] The partial safety factor γ_2 = 1,0 is included.
[3] Concrete edge failure see chapter 5.2.3.4 of Technical Report TR 029.

Table 23: Displacement under shear load in mm/kN [1]

HIT-HY 150 MAX HZA-R			M12	M16	M20	M24
Displacement	δ_{V0}	[mm/kN]	0,05	0,04	0,04	0,03
Displacement	$\delta_{V\infty}$	[mm/kN]	0,07	0,06	0,05	0,05

[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 = $\delta_{V\infty} \cdot V_{Sd}/1,4$