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Authorised and notified according to Article 10 of the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products (89/106/EEC)

DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-05/0051

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung *Trade name*	Injektionssystem Hilti HIT-HY 150 *Injection System Hilti HIT-HY 150*
Zulassungsinhaber *Holder of approval*	Hilti Aktiengesellschaft Business Unit Anchors 9494 Schaan FÜRSTENTUM LIECHTENSTEIN
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*	Verbunddübel in den Größen Ø 8 mm bis Ø 30 zur Verankerung im ungerissenen Beton *Bonded anchor in the size of Ø 8 to Ø 30 for use in non-cracked concrete*
Geltungsdauer: *Validity:* vom *from*	22 October 2008
bis *to*	17 March 2010
verlängert *extended* vom *from*	11 March 2010
bis *to*	17 March 2011
Herstellwerk *Manufacturing plant*	Hilti Werke

Diese Zulassung umfasst *This Approval contains*	26 Seiten einschließlich 17 Anhänge *26 pages including 17 annexes*

I LEGAL BASES AND GENERAL CONDITIONS

1 This European technical approval is issued by Deutsches Institut für Bautechnik 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 Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998[4], as amended by law of 31 October 2006[5];
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6];
- Guideline for European technical approval of "Metal anchors for use in concrete - Part 5: Bonded anchors", ETAG 001-05.

2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to 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 manufacturers 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 Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of 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 Deutsches Institut für Bautechnik. 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 fully to the version circulated in 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 February 1989, p. 12
2 Official Journal of the European Communities N° L 220, 30 August 1993, p. 1
3 Official Journal of the European Union N° L 284, 31 October 2003, p. 25
4 *Bundesgesetzblatt Teil I 1998*, p. 812
5 *Bundesgesetzblatt Teil I 2006*, p.2407, 2416
6 Official Journal of the European Communities N° L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of the construction product

The Injection System Hilti HIT-HY 150 for non-cracked concrete is a bonded anchor consisting of a foil pack with injection mortar Hilti HIT-HY 150 and a steel element.

The steel elements are made of zinc coated steel (threaded rod HIT-V, HAS-(E), internal sleeve HIS-N), reinforcing bar BSt 500 S, stainless steel (threaded rod HIT-V-R, HAS-(E)R, internal sleeve HIS-RN) or high corrosion resistant steel (threaded rods HIT-V-HCR and HAS-(E)HCR).

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

An illustration of the product and intended use is given 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 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 European technical approval. 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 C20/25 at minimum and C50/60 at most according to EN 206:2000-12.

The anchor may be used in non-cracked concrete only.

The anchor may be installed in dry or wet concrete; it must not be installed in flooded holes.

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)

<u>Elements made of zinc coated steel (threaded rods HIT-V and HAS-(E), internal sleeve HIS-N):</u>

The element made of electroplated or hot-dipped galvanised steel may only be used in structures subject to dry internal conditions.

<u>Elements made of stainless steel (threaded rods HIT-V-R and HAS-(E)R, internal sleeve HIS-RN):</u>

The element made of stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439 or 1.4362 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 to 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).

Elements made of high corrosion resistant steel (threaded rods HIT-V-HCR and HAS-(E)HCR):

The element made of high corrosion resistant steel 1.4529 or 1.4565 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 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 chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Elements made of reinforcing bars BSt 500 S:

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 EN 1992-1-1: 2004 are not covered by this European technical approval.

The provisions made in this European technical approval are based on an assumed 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 the product and methods of verification

2.1 Characteristics of the product

The anchor corresponds to the drawings and provisions given in Annexes 3 to 5. The characteristic material values, dimensions and tolerances of the anchor not indicated in Annexes 3 to 5 shall correspond to the respective values laid down in the technical documentation[7] of this European technical approval.

The characteristic values for the design of anchorages are given in Annexes 10 to 17.

The two components of the injection mortar Hilti HIT-HY 150 are delivered in 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 mark "HY 150", with the production date and expiry date.

Each threaded rod HIT-V is marked with the marking of steel grade 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".

7 The technical documentation of this European technical approval is deposited at the Deutsches Institut für Bautechnik 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.

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.

Explanations of the markings are given in Annexes 3 and 4.

Elements made of reinforcing bar BSt 500 S shall comply with the specifications given in Annex 5.

The marking of embedment depth may be done on jobsite.

2.2 Methods of verification

The assessment of fitness 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 Construction Products Directive, these requirements need also to be complied with, when and where they apply.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the Decision 96/582/EG of the European Commission[8] system 2(i) (referred to as System 1) of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

(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 control 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.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

8 Official Journal of the European Communities L 254 of 08.10.1996

The manufacturer may only use initial/raw/constituent materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Deutsches Institut für Bautechnik.[9]

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

3.2.1.2 Other tasks for 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 anchors in order to undertake the actions laid down in section 3.2.2 For this purpose, the control plan referred to in sections 3.2.1.1 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 for the approved bodies

The approved body shall perform the

- initial type-testing of the product,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control,

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

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.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be affixed on each packaging of the anchor. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European technical approval,
- the number of the guideline for European technical approval,
- use category (ETAG 001-1, Option 7),
- size

9 The control plan is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed data/information, deposited at Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik 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 Design of anchorages

The fitness 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 "Design of bonded anchors"[10] under the responsibility of an engineer experienced in anchorages and concrete work.

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 reinforcing bars 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.

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.).

4.3 Installation of anchors

The fitness 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 of the site,
- anchor installation in accordance with the manufacturer’s specifications and drawings using the tools indicated in the technical documentation of this European technical approval,
- use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor,

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10 The Techncial Report TR 029 "Design of bonded anchors" is published in English on EOTA website www.eota.eu.

- commercial standard threaded rods, washers and hexagon nuts may also be used if the following requirements are fulfilled:
  - material, dimensions and mechanical properties of the metal parts according to the specifications given in Annex 5, Table 4,
  - 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.
- 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 given and is not lower than that of the concrete to which the characteristic loads apply,
- check of concrete being well compacted, e.g. without significant voids,
- marking and keeping the effective anchorage depth,
- edge distance and spacing not less than the specified values without minus tolerances,
- positioning of the drill holes without damaging the reinforcement,
- drilling by hammer-drilling,
- in case of aborted drill hole: the drill hole shall be filled with mortar,
- the anchor must not be installed in flooded holes,
- cleaning the drill hole in accordance with Annexes 6 to 8,
- the anchor component installation temperature shall be at least +5 °C; during curing of the chemical mortar the temperature of the concrete must not fall below -5 °C; observing the curing time according to Annex 8, Table 5 until the anchor may be loaded,
- 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,
- installation torque moments are not required for functioning of the anchor. However, the torque moments given in Annexes 3 and 4 must not be exceeded.

5 Recommendations concerning packaging, transport and storage

5.1 Responsibility of the manufacturer

The manufacturer is responsible to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to and 4.2 and 4.3 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,
- 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.

5.2 Packaging, transport and storage

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

Foil packs with expired shelf life must no longer be used.

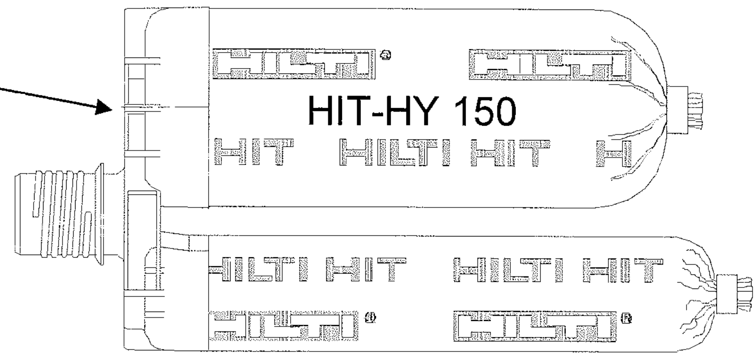
The anchor shall only be packaged and supplied as a complete unit. Foil packs may be packed separately from metal parts.

Dipl.-Ing. Georg Feistel
Head of Division Construction Engineering
of Deutsches Institut für Bautechnik
Berlin, 11 March 2010

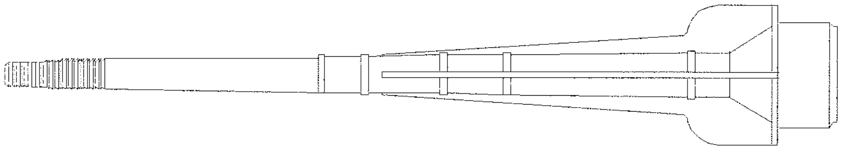
beglaubigt
G. Lange

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

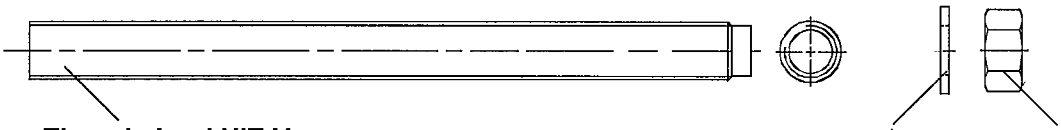
Foil pack 330ml, 500ml and 1400ml



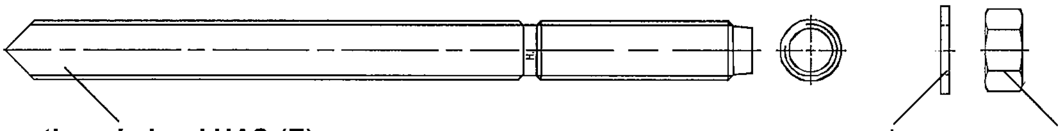
Static Mixer HIT-M1



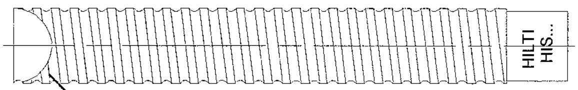
Steel elements:



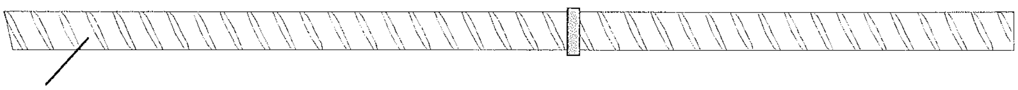
Threaded rod HIT-V ...
thread sizes M8, M10, M12, M16, M20, M24, M27 or M30



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

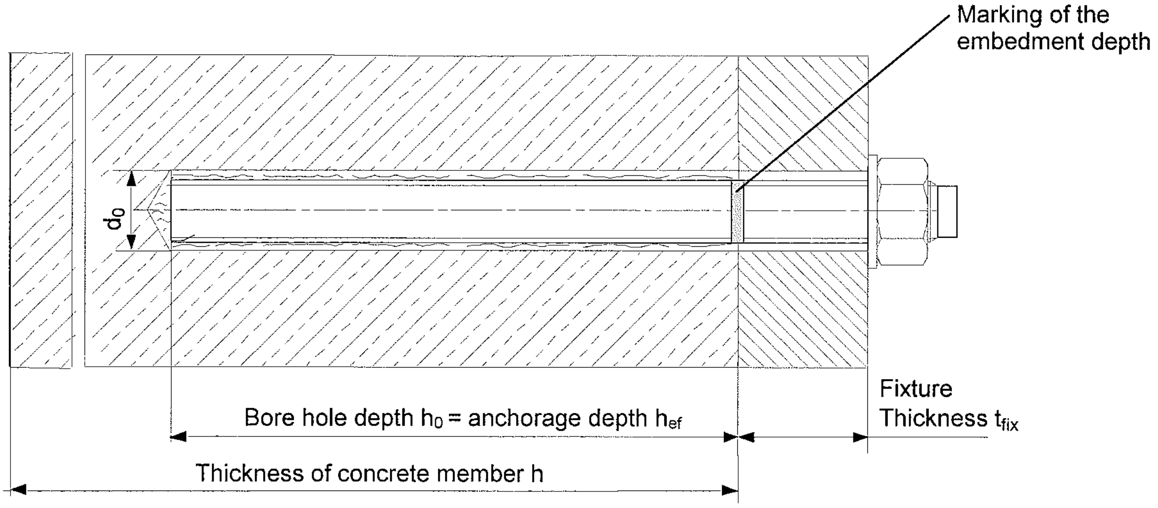


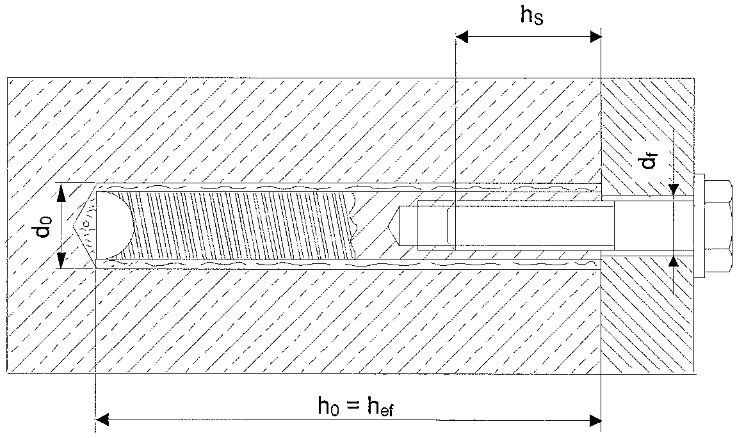
Internal sleeve HIS-(R)N ...
thread sizes M8, M10, M12, M16 or M20

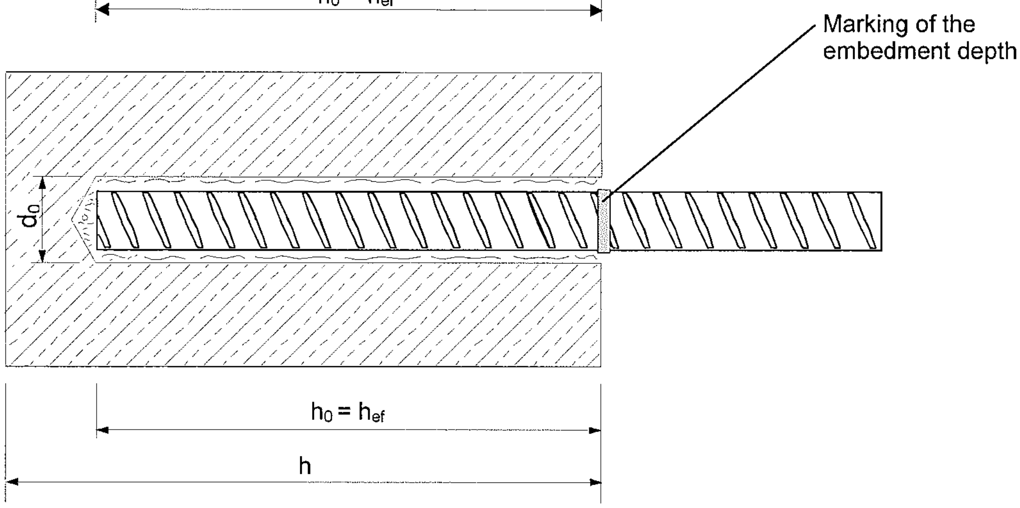


Rebar BSt 500 S
diameter ø8, ø10, ø12, ø14, ø16, ø20, or ø25

Injection System Hilti HIT-HY 150	**Annex 1**
Product and intended use	of European technical approval ETA – 05/0051







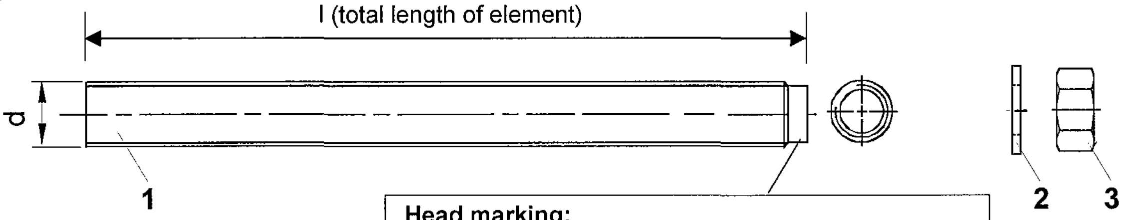
Use category:	**Installation in dry or water saturated concrete, (not in flooded holes)**	
Temperature range I:	-40°C to +40°C	(max long term temperature +24°C and max short term temperature +40°C)
Temperature range II:	-40°C to +80°C	(max long term temperature +50°C and max short term temperature +80°C)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

Injection System Hilti HIT-HY 150	**Annex 2**
Installed anchor and intended use	of European technical approval ETA – 05/0051

Table 1: Installation parameters of anchor rod HIT-V... and HAS-(E)...

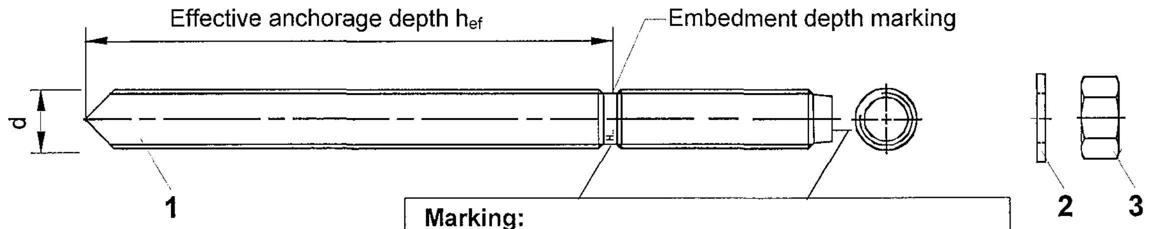
HIT-HY 150 with HIT-V-... and HAS-(E)...			M8	M10	M12	M16	M20	M24	M27	M30
Diameter of element	d	[mm]	8	10	12	16	20	24	27	30
Range of anchorage depth h_{ef} and bore hole depth h_0 **HIT-V-...**	min	[mm]	60	60	70	80	90	100	110	120
	max	[mm]	160	200	240	320	400	480	540	600
Effective anchorage depth **HAS-(E)...**	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	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 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

HIT-V...



Head marking:
5.8 - l (= HIT-V-5.8) M...x l; M8 - M24
5.8F - l (= HIT-V-5.8F) M...x l; M8 - M24
8.8 - l (= HIT-V-8.8) M...x l; M27, M30
8.8F - l (= HIT-V-8.8F) M...x l; M27, M30
R - l (= HIT-V-R) M...x l
HCR - l (= HIT-V-HCR) M...x l

HAS-(E)...



Marking:
identifying mark - H, embossing "1" HAS-(E)
identifying mark - H, embossing "=" HAS-(E)R
identifying mark - H, embossing "CR" HAS-(E)HCR

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

HIT-HY 150 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

HIS-(R)N...

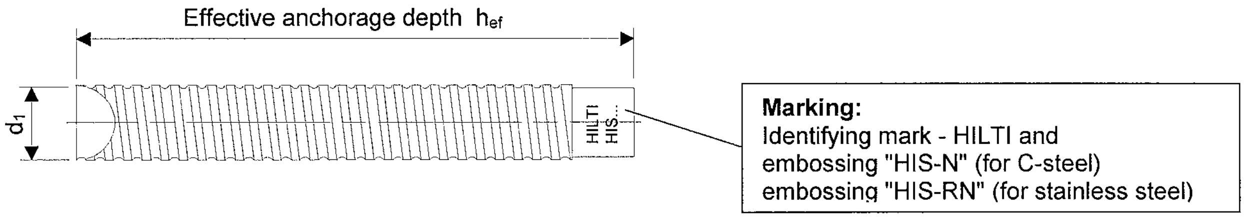


Table 3: Installation parameters of anchor element rebar

HIT-HY 150 with BSt 500 S			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

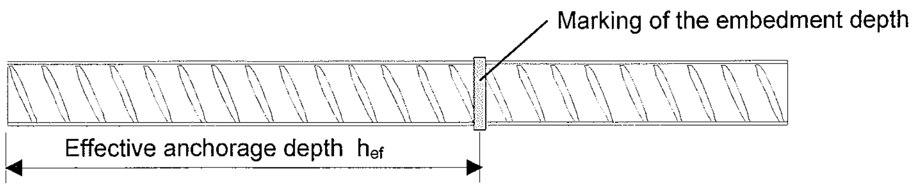


Table 4: Materials

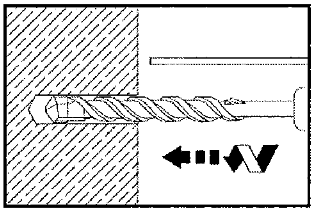
Designation	Material
Metal parts made of rebar	
BSt 500 S	Mechanical properties according to DIN 488-1:1984 Geometry according to DIN 488-2:1986
Metal parts made of zinc coated steel	
threaded rod HIT-V-5.8(F) HAS-(E) M8 to M24	strength class 5.8 EN ISO 898-1, $A_5 > 8\%$ Ductile steel galvanized ≥ 5µm 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, $A_5 > 8\%$ 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	carbon steel 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; $A_5 > 8\%$ Ductile for > M24: strength class 50 EN ISO 3506-1; $A_5 > 8\%$ 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
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

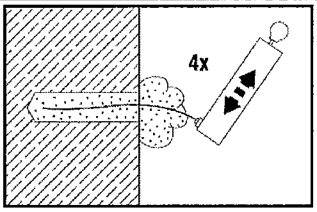


Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

Bore hole cleaning

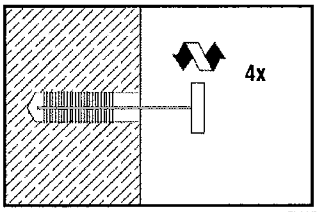
Just before setting an anchor, the bore hole must be free of dust and debris.

a) Manual Cleaning (MC) for bore hole diameters $d_0 \leq$ 18mm and bore hole depth $h_0 \leq 10d_S$

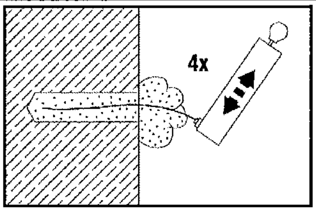


The Hilti manual pump may be used for blowing out bore holes up to diameters $d_0 \leq$ 18 mm and embedment depths up to $h_{ef} \leq 10d_S$.

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

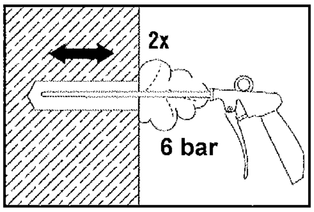


Brush 4 times with the specified brush size (brush Ø ≥ bore hole Ø, see Table 6) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the bore hole -- if not, the brush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

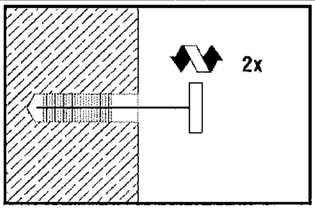


Blow out again with manual pump at least 4 times until return air stream is free of noticeable dust.

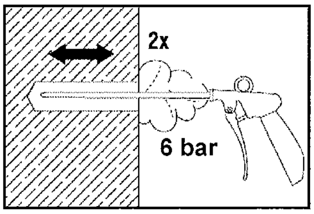
b) Compressed air cleaning (CAC) for all bore hole diameters d_0 and all bore hole depth h_0



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 m³/h) until return air stream is free of noticeable dust.

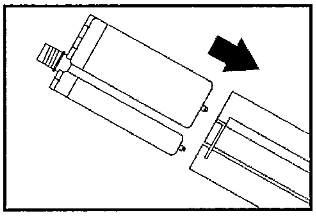


Brush 2 times with the specified brush size (brush Ø ≥ bore hole Ø, see Table 6) by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the bore hole -- if not, the brush is too small and must be replaced with the proper brush diameter.

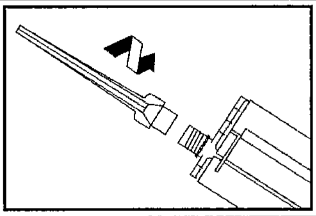


Blow again with compressed air 2 times until return air stream is free of noticeable dust.

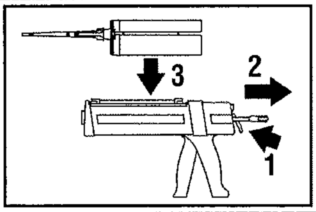
Injection preparation



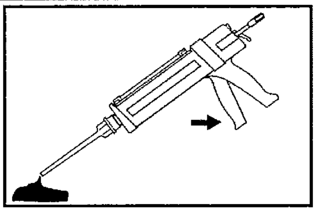
Insert foil pack in foil pack holder. Never use damaged foil packs and/or damaged or unclean foil pack holders. Attach new mixer prior to dispensing a new foil pack (snug fit).



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.



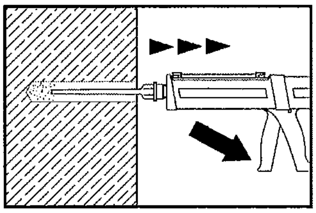
Insert foil pack holder with foil pack into HIT-dispenser. Push release trigger, retract plunger and insert foil pack holder into the appropriate Hilti dispenser.



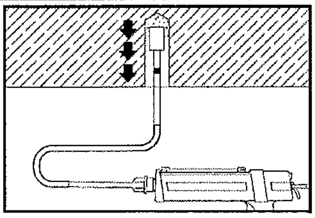
Discard initial adhesive. The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.

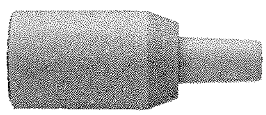
Discard quantities are	2 strokes	for 330ml foil pack,
	3 strokes	for 500ml foil pack and
	45 ml	for 1400ml foil pack.

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.



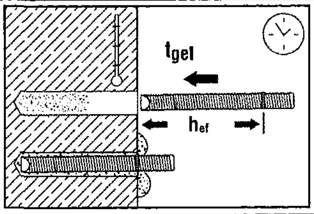


Overhead installation and installation with embedment depth h_{ef} > 250mm

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 6).

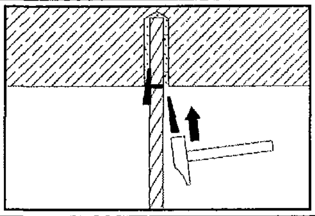
Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the bore hole by the adhesive pressure.

Setting the element

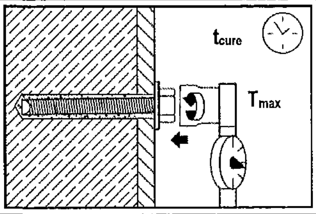


Before use, verify that the element is dry and free of oil and other contaminants.

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 use piston plugs and fix embedded parts with e.g. wedges.



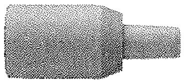
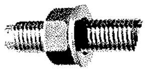
Loading the anchor:
After required curing time t_{cure} (see Table 5) the anchor can be loaded. The applied installation torque shall not exceed the values T_{max} given in Table 1 and Table 2.

Table 5: Working time, curing time [1)]

Base material temperature	Working time "t_{gel}"	Curing time "t_{cure}"
-5 °C ≤ $T_{base\ material}$ < 0°C	90 min	9 h
0 °C ≤ $T_{base\ material}$ < 5°C	45 min	4,5 h
5 °C ≤ $T_{base\ material}$ < 10°C	25 min	2 h
10 °C ≤ $T_{base\ material}$ < 20°C	6 min	90 min
20 °C ≤ $T_{base\ material}$ < 30°C	4 min	50 min
30 °C ≤ $T_{base\ material}$ ≤ 40 °C	2 min	40 min

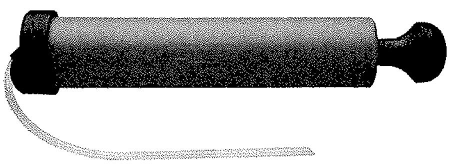
[1)] The curing time data are valid for dry anchorage base only.
In water saturated anchorage base the curing times must be doubled.

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

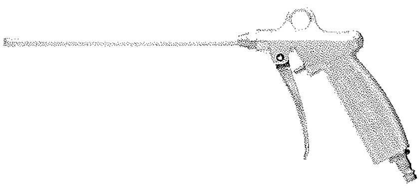
Element	Size	Nominal drill bit diameter d_0 [mm]	Steel brush HIT-RB	Piston plug HIT-SZ	Cleaning methods	
					Manual cleaning (MC)	Compressed air cleaning (CAC)
HIT-V / HAS 	M8	10	HIT-RB 10	-	Yes … $h_{ef} \leq$ 80mm	Yes
	M10	12	HIT-RB 12	HIT-SZ 12	Yes … $h_{ef} \leq$100mm	Yes
	M12	14	HIT-RB 14	HIT-SZ 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 12 [1]	HIT-RB 10 HIT-RB 12	HIT-SZ 10 HIT-SZ 12	Yes … $h_{ef} \leq$ 80mm	Yes
	Ø10	12 14 [1]	HIT-RB 12 HIT-RB 14	HIT-SZ 12 HIT-SZ 14	Yes … $h_{ef} \leq$100mm	Yes
	Ø12	14 16 [1]	HIT-RB 14 HIT-RB 16	HIT-SZ 14 HIT-SZ 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

[1] Both given values for drill bit diameter can be used.

Manual Cleaning (MC):
Hilti hand pump recommended for blowing out bore holes with diameters $d_0 \leq 18$mm and bore hole depth $h_0 \leq 10 d_S$.



Compressed air cleaning (CAC):
Air nozzle with an orifice opening of minimum 3,5 mm in diameter recommended for blowing out with compressed air (min. 6 bar at 6 m^3/h).



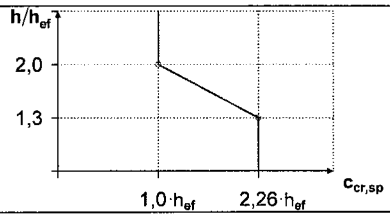
Injection System Hilti HIT-HY 150

Bore hole cleaning
Installation with piston plug

Annex 9
of European technical approval
ETA – 05/0051

Table 7: Design method A, Characteristic tension load values

HIT-HY 150 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-5.8	$N_{Rk,s}$	[kN]	**17**	**26**	**38**	**72**	**112**	**160**	-	-
Characteristic resistance HAS-8.8	$N_{Rk,s}$	[kN]	-	-	-	-	-	-	**347**	**422**
Partial safety factor	$\gamma_{Ms,N}$ 1)	[-]	1,5							
Characteristic resistance HAS-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-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**	τ_{Rk}	[N/mm²]	**11,0**	**11,0**	**11,0**	**9,0**	**8,5**	**8,0**	**7,5**	**7,0**
Temperature range II 3): **80°C/50°C**	τ_{Rk}	[N/mm²]	**7,5**	**7,5**	**7,5**	**6,0**	**5,5**	**5,0**	**5,0**	**5,0**
Temperature range III 3): **120°C/72°C**	τ_{Rk}	[N/mm²]	**6,5**	**6,5**	**6,5**	**5,0**	**5,0**	**4,5**	**4,0**	**4,0**
Increasing factor for $\tau_{Rk,p}$ in non cracked concrete	ψ_c	C30/37	1,06							
		C40/50	1,11							
		C50/60	1,14							
Splitting failure 2)										
Edge distance $c_{cr,sp}$ [mm] for		h / h_{ef} 4) ≥ 2,0	**1,0 h_{ef}**							
		2,0 > h / h_{ef} 4) > 1,3	**4,6 h_{ef} - 1,8 h**							
		h / h_{ef} 4) ≤ 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)	[-]	1,5 5)	1,8 6)	1,8 6)	2,1 7)	2,1 7)	2,1 7)	2,1 7)	2,1 7)



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) h ... concrete member thickness, h_{ef} ... effective anchorage depth
5) The partial safety factor γ_2 = 1,0 is included.
6) The partial safety factor γ_2 = 1,2 is included.
7) The partial safety factor γ_2 = 1,4 is included.

Table 8: Displacements under tension load [1)]

HIT-HY 150 with HIT-V-... / HAS(-E)-...			M8	M10	M12	M16	M20	M24	M27	M30
Temperature range I [2)]: 40°C / 24°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,03	0,03	0,03	0,04	0,05	0,05	0,06	0,06
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,08	0,09	0,10	0,12	0,14	0,16	0,17	0,19
Temperature range II [2)]: 80°C / 50°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,04	0,04	0,05	0,05	0,06	0,06	0,07	0,07
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,10	0,11	0,12	0,14	0,16	0,18	0,20	0,21
Temperature range III [2)]: 120°C / 72°C										
Displacement	δ_{N0}	[mm/(N/mm²)]	0,04	0,05	0,05	0,06	0,06	0,07	0,07	0,08
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,13	0,14	0,15	0,17	0,19	0,21	0,22	0,24

[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 9: Design method A, Characteristic shear load values

HIT-HY 150 with HIT-V-... / HAS(-E)-...			M 8	M 10	M 12	M 16	M 20	M 24	M 27	M 30
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-5.8	$V_{Rk,s}$	[kN]	8,5	13	19	36	56	80	-	-
Characteristic resistance HAS-8.8	$V_{Rk,s}$	[kN]	-	-	-	-	-	-	174	211
Characteristic resistance HAS-R	$V_{Rk,s}$	[kN]	12	19	27	51	79	112	108	132
Characteristic resistance HAS-HCR	$V_{Rk,s}$	[kN]	13	21	31	58	90	112	152	184
Steel failure 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-5.8	$M^0_{Rk,s}$	[Nm]	16	33	56	147	284	486	-	-
Characteristic resistance HAS-8.8	$M^0_{Rk,s}$	[Nm]	-	-	-	-	-	-	1223	1637
Characteristic resistance HAS-R	$M^0_{Rk,s}$	[Nm]	23	45	79	205	398	680	764	1023
Characteristic resistance HAS-HCR	$M^0_{Rk,s}$	[Nm]	26	52	90	234	455	680	1070	1433
Partial safety factor steel failure										
HIT-V / HAS grade 5.8 or 8.8	$\gamma_{Ms,V}$ [2]	[-]	1,25							
HIT-V-R / HAS-R	$\gamma_{Ms,V}$ [2]	[-]	1,56						2,38	
HIT-V-HCR / HAS-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							
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 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.
[4] Concrete edge failure see chapter 5.2.3.4 of Technical Report TR 029.

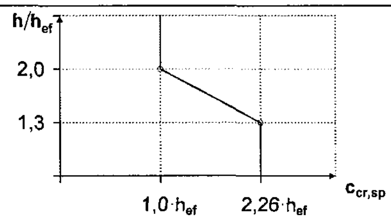
Table 10: Displacement under shear load [1]

HIT-HY 150 with HIT-V-... / HAS(-E)-...			M8	M10	M12	M16	M20	M24	M27	M30
Displacement	δ_{V0}	[mm/kN]	0,09	0,07	0,06	0,05	0,04	0,03	0,03	0,02
Displacement	$\delta_{V\infty}$	[mm/kN]	0,14	0,11	0,09	0,07	0,06	0,05	0,04	0,04

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

Table 11: Design method A, Characteristic tension load values

HIT-HY 150 with rebar BSt 500 S	**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**
Steel failure rebar BSt 500 S							
Characteristic resistance HIT-V-5.8(F) $N_{Rk,s}$ [kN]	28	43	62	85	111	173	270
Partial safety factor $\gamma_{Ms,N}$ [1] [-]	1,4						
Combined Pull-out and Concrete cone failure [2]							
Diameter of threaded rod d [mm]	8	10	12	14	16	20	25
Characteristic bond resistance in non-cracked concrete C20/25							
Temperature range I [3]: **40°C/24°C** τ_{Rk} [N/mm²]	8,5	8,5	8,5	7,5	7,5	7,5	7,5
Temperature range II [3]: **80°C/50°C** τ_{Rk} [N/mm²]	6,0	6,0	6,0	5,0	5,0	5,0	5,0
Temperature range III [3]: **120°C/72°C** τ_{Rk} [N/mm²]	5,0	5,0	5,0	4,5	4,5	4,5	4,5
Increasing factor for $\tau_{Rk,p}$ in non cracked concrete ψ_c C30/37	1,06						
Increasing factor for $\tau_{Rk,p}$ in non cracked concrete ψ_c C40/50	1,11						
Increasing factor for $\tau_{Rk,p}$ in non cracked concrete ψ_c C50/60	1,14						
Splitting failure [2]							
Edge distance $c_{cr,sp}$ [mm] for h / h_{ef} [4] $\geq 2{,}0$	**1,0 h_{ef}**						
Edge distance $c_{cr,sp}$ [mm] for $2{,}0 > h / h_{ef}$ [4] $> 1{,}3$	**4,6 h_{ef} - 1,8 h**						
Edge distance $c_{cr,sp}$ [mm] for h / h_{ef} [4] $\leq 1{,}3$	**2,26 h_{ef}**						
Spacing $s_{cr,sp}$ [mm]	2 $c_{cr,sp}$						
Partial safety factor $\gamma_{Mp} = \gamma_{Mc} = \gamma_{Msp}$ [1] [-]	1,5 [5]	1,8 [6]	1,8 [6]	2,1 [7]	2,1 [7]	2,1 [7]	2,1 [7]



[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] h … concrete member thickness, h_{ef} … effective anchorage depth
[5] The partial safety factor $\gamma_2 = 1{,}0$ is included.
[6] The partial safety factor $\gamma_2 = 1{,}2$ is included.
[7] The partial safety factor $\gamma_2 = 1{,}4$ is included.

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

Table 12: Displacements under tension load [1)]

HIT-HY 150 with rebar BSt 500 S			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25
Temperature range I [2)]: 40°C / 24°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	0,03	0,03	0,03	0,04	0,04	0,05	0,05
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,08	0,09	0,10	0,11	0,12	0,14	0,16
Temperature range II [2)]: 80°C / 50°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	0,04	0,04	0,05	0,05	0,05	0,06	0,07
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,10	0,11	0,12	0,13	0,14	0,16	0,19
Temperature range III [2)]: 120°C / 72°C									
Displacement	δ_{N0}	[mm/(N/mm²)]	0,04	0,05	0,05	0,05	0,06	0,06	0,07
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0,13	0,14	0,15	0,16	0,17	0,19	0,21

[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 13: Design method A, Characteristic shear load values

HIT-HY 150 with rebar BSt 500 S			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25
Steel failure without lever arm									
Characteristic shear resistance rebar BSt 500 S	$V_{Rk,s}$	[kN]	14	22	31	42	55	86	135
Partial safety factor	$\gamma_{Ms,V}$ [1)]	[-]	1,5						
Steel failure with lever arm									
Characteristic shear resistance rebar BSt 500 S	$M^0_{Rk,s}$	[Nm]	33	65	112	178	265	518	1012
Partial safety factor	$\gamma_{Ms,V}$ [1)]	[-]	1,5						
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} [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.

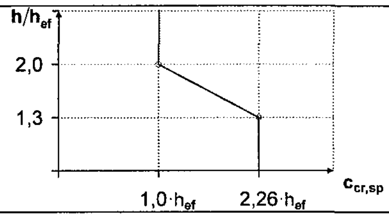
Table 14: Displacements under shear load [1)]

HIT-HY 150 with rebar BSt 500 S			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25
Displacement	δ_{V0}	[mm/kN]	0,09	0,07	0,06	0,05	0,05	0,04	0,03
Displacement	$\delta_{V\infty}$	[mm/kN]	0,14	0,11	0,09	0,08	0,07	0,06	0,05

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

Table 15: Design method A, Characteristic values to tension loads

HIT-HY 150 with HIS-(R)N			M 8	M 10	M 12	M 16	M 20
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 bond resistance in non-cracked concrete C20/25							
Temperature range I 3)**: 40°C/24°C**	**N_{Rk}** 4)	[kN]	**35**	**40**	**60**	**115**	**140**
Temperature range II 3)**: 80°C/50°C**	**N_{Rk}** 4)	[kN]	**20**	**30**	**40**	**75**	**95**
Temperature range III 3)**:120°C/72°C**	**N_{Rk}** 4)	[kN]	**16**	**20**	**30**	**50**	**60**
Increasing factor for $N_{Rk,p}$ in non cracked concrete	ψ_c	C30/37	1,06				
		C40/50	1,11				
		C50/60	1,14				
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)	[-]	1,5 5)	1,5 5)	1,5 5)	1,8 6)	1,8 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: $\tau_{Rk} = N_{Rk}/(h_{ef}\ d_1\ \pi)$;
5) The partial safety factor γ_2 = 1,0 is included.
6) The partial safety factor γ_2 = 1,2 is included.

Table 16: Displacements under tension load 1)

HIT-HY 150 with HIS-(R)N			M8	M10	M12	M16	M20
Temperature range I 2)**: 40°C / 24°C**							
Displacement	δ_{N0}	[mm/10kN]	0,17	0,13	0,10	0,07	0,06
Displacement	$\delta_{N\infty}$	[mm/10kN]	0,45	0,35	0,28	0,20	0,15
Temperature range II 2)**: 80°C / 50°C**							
Displacement	δ_{N0}	[mm/10kN]	0,17	0,13	0,10	0,07	0,06
Displacement	$\delta_{N\infty}$	[mm/10kN]	0,45	0,35	0,28	0,20	0,15
Temperature range III 2)**: 120°C / 72°C**							
Displacement	δ_{N0}	[mm/10kN]	0,55	0,41	0,32	0,22	0,16
Displacement	$\delta_{N\infty}$	[mm/10kN]	0,19	0,15	0,12	0,08	0,06

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

Table 17: Design method A, Characteristic values to shear loads

HIT-HY 150 with HIS-(R)N			M 8	M 10	M 12	M 16	M20
Steel failure [1] without lever arm							
Characteristic resistance HIS-N screw class 8.8	$V_{Rk,s}$	[kN]	**13**	**23**	**39**	**59**	**55**
Partial safety factor	$\gamma_{Ms,V}$ [2]	[-]	1,25		1,5		
Characteristic resistance HIS-RN screw class 70	$V_{Rk,s}$	[kN]	**13**	**20**	**30**	**55**	**83**
Partial safety factor	$\gamma_{Ms,V}$ [2]	[-]	1,56				2,0
Steel failure 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 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 γ_2 = 1,0 is included.

Table 18: Displacements under shear load [1]

HIT-HY 150 with HIS-(R)N			M8	M10	M12	M16	M20
Displacement	δ_{V0}	[mm/kN]	0,08	0,07	0,07	0,05	0,05
Displacement	$\delta_{V\infty}$	[mm/kN]	0,13	0,11	0,10	0,08	0,07

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