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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-08/0202

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

Nom commercial : **Trade name:**	**Injection System Hilti HIT-HY 150 MAX for rebar connection**
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:**	Scellement d'armatures rapportées, diamètres 8 à 25mm, avec Système d'injection Hilti HIT-HY 150 MAX **Post installed rebar connections diameter 8 to 25 mm made with Hilti HIT-HY 150 MAX injection mortar.**
Validité du : au : **Validity from / to:**	**25/06/2013** **25/06/2018**
Usine de fabrication : **Manufacturing plant:**	**Hilti Plants**
Le présent Agrément technique européen contient : **This European Technical Approval contains:**	28 pages incluant 17 annexes faisant partie intégrante du document. **28 pages including 17 annexes which form an integral part of the document.**

Cet Agrément Technique Européen annule et remplace l'ATE-08/0202 valide du 06/07/2012 au 06/07/2017
This European Technical Approval cancels and replaces the ETA-08/0202 with validity from 06/07/2012 to 06/07/2017

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 », Part 5 « Bonded anchors» and Technical Report for Post Installed Rebar Connections TR23.
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.

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

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

3 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 Hilti HIT-HY 150 MAX is used for the connection, by anchoring or overlap joint, of reinforcing bars (rebars) in existing structures made of ordinary non-carbonated concrete C12/15 to C50/60. The design of the post-installed rebar connections is done in accordance with EN 1992-1-1 October 2005 (Eurocode 2).

Covered are rebar anchoring systems consisting of Hilti HIT-HY 150 MAX bonding material and the Hilti tension anchor HZA-R sizes M12, M16, M20 and M24 or an embedded straight deformed reinforcing bar diameter, d, from 8 to 25 mm with properties according to Annex C of EN 1992-1-1 and EN 10080. The classes B and C of the rebar are recommended.

1.2 Intended use

The ETA covers applications in non-carbonated concrete C 12/15 to C 50/60 (EN 206-1) only, which are also allowed with straight deformed cast-in bars according to EN 1992-1-1, e.g. those in the following applications:

- overlapping joints with existing reinforcement in a building component, Figure 1 and 2 in Annex 2.
- anchoring of the reinforcement at a slab or beam support; end support/bearing of a slab designed as simply supported as well as its reinforcement for restraint forces, Figure 3 in Annex 2.
- anchoring of reinforcement of building components stressed primarily in compression, Figure 4 in annex 2.
- anchoring of reinforcement to cover the line of acting tensile force, Figure 5 in Annex 2.
- Rebar connections with the Hilti HZA-R may be used for the transmission of tensile forces in the direction of the bar axis only. The transmission of shear forces has to be ensured by appropriate measures, Figure 6, 7 and 8 in Annex 3.

The Hilti HIT-HY 150 MAX anchoring systems can be used with the following limitations:

- ✓ The rebars can be placed in holes made with hammer drilling or compress air drilling only.
- ✓ The rebars may be used in the following temperature range: -40°C to +80°C (max short term temperature +80°C and max long term temperature +50°C).
- ✓ According to EN 206-1 the allowable chloride content in concrete is limited to 0.40% (Cl 0,40) related to cement content.
- ✓ The rebars may be installed in dry or wet concrete, but must not be installed in flooded holes.
- ✓ The rebar connections may be used for predominantly static loads.

The fire resistance of post-installed rebar connections is not covered by this ETA.
Fatigue, dynamic or seismic loading of post-installed rebar connections are not covered by this ETA.

The provisions made in this European Technical Approval are based on an assumed intended working life of the rebar connections 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 Hilti HIT-HY 150 MAX injection adhesive corresponds to the drawings and provisions given in Annexes 1 to 7.

The Hilti HIT-HY 150 MAX injection adhesive is a two components system. The two components of the injection mortar are delivered in unmixed condition in foil packs of sizes 330ml, 500ml or 1400ml according to annex 1. Each foil pack is marked with the identifying mark “Hilti HIT-HY 150 MAX” with the production date and expiration date.

2.2 Methods of verification

The assessment of fitness of the rebar connection 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 », Part 5 « Bonded anchors » and Technical Report n° 023 “Assessment of post installed rebar connections”.

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.

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[6]. 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.

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6 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, TR 023);
- The last two digits of the year in which the CE-marking was affixed;
- Size.

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

4.1 Manufacturing

The resin and the Hilti tension anchor HZA-R are 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 Drafting

Rebar connection must be designed in keeping with good engineering practice. Allowing for the loads to be anchored, design calculations and design drawings must be produced which can be checked. At least the following must be given in the design drawings:

- Concrete strength.
- Diameter, drilling technique, concrete cover, spacing and anchorage depth of the rebars.
- Dimension for the depth of adhesive (dispensing amount to be marked on the mixer extension as per Annex 13.
- Use of a guide device (drilling aid) for the drilling holes close to edges (if necessary).
- Kind of preparation of the joint between building components being connected.

4.3 Rebar connection design as per EN 1992-1-1

4.3.1 General points

The actual position of the reinforcement in the existing building component must be determined on the basis of the construction documentation and allowed for when drafting.
The transfer of internal section forces in the joint must be verified in accordance to EN 1992-1-1 when a new building component is being connected. The transfer of shear forces between new and old concrete shall be designed according to EN 1992-1-1. The joints for concreting must be roughened to at least such an extent that aggregate protrude.

The design of rebar connections and determination of the internal section forces to be transferred in the construction joint shall be in keeping with the EN 1992-1-1.

Hilti tension anchor HZA-R according to Annexes 6 and 7 shall be designed for the welded-on reinforcement steel according to Table 1. The length of the bonded-in smooth shaft made of stainless steel may not be accounted as anchorage.

Verification of immediate local force transfer to the concrete has been provided.

Verification of the transfer of the loads to be anchored to the building component must be provided.

The spacing between post installed rebars respectively Hilti tension anchor HZA-R shall be greater than the maximum of $5d_s$ and 50mm (according to Annex 5 respectively Annex 7).

4.3.2 Determination of anchorage depth.

4.3.2.1 General points

The design anchorage length l_{bd} must be determined according to EN 1992-1-1, section 8.4.3.

The anchorage depths and overlap lengths must not be less than the minimum values given in Annex 8. The maximum permissible anchorage depth is given in Annex 8.

4.3.2.2 Calculation of the basic anchorage length $l_{b,rqd}$

The basic anchorage length $l_{b,rqd}$, for anchoring the force $A_s.f_{yd}$ in the rebar assuming constant bond stress equal to f_{bd} follows from:

$l_{b,rqd}=(\phi/4).(\sigma_{sd}/f_{bd})$

where: ϕ = diameter of the rebar

σ_{sd} = calculated stress in the rebar under the design action

f_{bd} = design value of the bond strength according to table 5 in annex 8

$f_{bd} = 2.25\ \eta_1\ \eta_2 f_{ctd}$ (according to EN 1992-1-1)

with $f_{ctd} = \alpha_{ct}\ f_{ctk,0.05} / \gamma_c$

$\alpha_{ct} = 1$ and $\gamma_c = 1.5$

η_1 coefficient relative to the quality of the bond condition and position of the rebar during concreting

$\eta_1 = 1,0$ (“good” bond conditions)

$\eta_1 = 0,7$ (all other conditions)

$\eta_2 = 1,0$ (for $\varnothing \leq 25$mm)

4.3.2.3 Calculation of the minimum anchorage length $l_{b,min}$

Anchoring rebar

In the case of anchoring rebar, the minimum anchorage length $l_{b,min}$ must be determined as follow:

$l_{b,min}$ = Max (0,3 $l_{b,rqd}$; 10 ϕ; 100mm) under tension

$l_{b,min}$ = Max (0,6 $l_{b,rqd}$; 10 ϕ; 100mm) under compression

Overlap joint

In the case of overlap joint, the minimum anchorage length $l_{0,min}$ must be determined as follow:

$l_{0,min}$ = Max (0,3.α_6.$l_{b,rqd}$; 15 ϕ; 200mm)

where $\alpha_6 = (\rho_1 / 25)^{0.5} \leq 1.5$ with ρ_1 the percentage of reinforcement lapped within $0.65 \cdot l_0$ from the centre of the length considered.

4.3.2.4 Calculation of the design anchorage length l_{bd}

Anchoring rebar

In the case of anchoring rebar, the design anchorage length l_{bd} must be determined as follow:

$l_{bd} = \alpha_1\ \alpha_2\ \alpha_3\ \alpha_4\ \alpha_5\ l_{b,rqd} \geq l_{b,min}$

where α_1, α_2, α_3, α_4, α_5 are determined according to EN 1992-1-1.Table 8.2.

Overlap joint

In the case of overlap joint, the design anchorage length l_{bd} must be determined as follow:

$l_0 = \alpha_1\ \alpha_2\ \alpha_3\ \alpha_4\ \alpha_5\ \alpha_6\ l_{b,rqd} \geq l_{0,min}$

where α_1, α_2, α_3, α_4, α_5, α_6 determined according to, EN 1992-1-1.Table 8.2 and 8.3.

α_1	Influence of the shape of the rebar	$\alpha_1 = 1$ for straight rebar
α_2	Influence of the concrete cover	$0.7 \leq \alpha_2 \leq 1.0$ calculated according to EN 1992-1-1 Table 8.2
α_3	Influence of the confinement by transverse reinforcement not welded to main reinforcement	$\alpha_3 = 1$ because no transverse reinforcement
α_4	Influence of the confinement by welded transverse reinforcement	$\alpha_4 = 1$ because no transverse reinforcement
α_5	Influence of the confinement by transverse pressure	$0.7 \leq \alpha_5 \leq 1.0$
α_6	Influence of the overlapping length	$1.0 \leq \alpha_6 \leq 1.5$

Nota: Examples of calculations are published in Annexes 16 and 17 for concrete C20/25. Other values can be calculated by using the above formulas.

4.3.2.5 Embedment depth for overlap joints with Hilti tension anchor HZA-R

The effective embedment depth is the same as the lap length $l_v = l_0$ (Annex 7, Figure 12).

The total embedment depth $l_{e.ges}$ shall be determined as follows:

$l_{e.ges} \geq l_0 + l_e$ (Annex 7, Figure 12)

with: l_0, the required lap length acc. to Section 4.3.2 and to EN 1992-1-1
l_e, the length of the smooth shaft see also Annex 7, $l_e > c_1$

If the clear distance between overlapping rods exceeds $4d_s$, the overlap length shall be increased by the difference between the actual clear distance and $4d_s$.

4.3.2.6 Transverse reinforcement

The transverse reinforcement required in the zone of the rebar or of the tension anchor HZA-R connection must fulfil the requirement of EN 1992-1-1, section 8.7.4.

4.3.2.7 Connection joint

In case of a connection being made between new and existing concrete where the surface layer of the existing concrete is carbonated, the layer should be removed in the area of the new reinforcing bar (with a diameter ds + 60mm) prior to the installation of the new bar.

The foregoing may be neglected if building components are new and not carbonated.

4.3.2.8 Additional provisions

The concrete cover required for bonded-in rebars or tension anchor HZA-R is shown in Annex 8, Table 3, in relation to the drilling method and the hole tolerance.
Furthermore the minimum concrete cover given in EN 1992-1-1, Section 4.4.1.2 shall be observed.

4.4 Installation

The fitness for use of the rebar connection can only be assumed if the rebar is installed as follows:

- The installation of the post installed rebars respectively HZA-R shall be carried out according to the manufacturer's installation instructions and to the present ETA's Annexes 1 to 17.
- The installation of post-installed rebars respectively HZA-R shall be done only by suitable trained installer and under supervision on site. The conditions under which an installer may be considered as suitable trained and the conditions for supervision on site are up to the Member States in which the installation is done.
- Use of the system only as supplied by the manufacturer without exchanging the components of an system;
- Checks before placing the rebar to ensure that the strength class of the concrete in which the rebar is to be placed is in the range;
- The surface of the joint between new and existing concrete should be prepared (roughing, keying, according to the envisaged intended use according to EN 1992-1-1;
- Check of concrete being well compacted, e.g. without significant voids;
- Keeping the anchorage depth as specified in the design drawings;
- Keeping of the concrete cover and spacing as specified in the design drawings;
- The drilling and cleaning of the hole and the installation shall be performed only with the equipment as specified by the manufacturer given in Annexes 9 to 15. It shall be ensured that this equipment is available on site and is used;
- Positioning of the drill holes without damaging the reinforcement;
- In case of aborted drill hole: the drill hole shall be filled with mortar;
- The post installed rebar connection must not be installed in flooded holes;
- Rebar installation ensuring the specified embedment depth, that is the appropriate depth marking of the rebar not exceeding the concrete surface;

4.5 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 § 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,
- rebar diameter,
- admissible service temperature range,
- curing time of the bonding material depending on the installation temperature,
- information on the installation procedure, including cleaning of the hole, preferably by means of an illustration,
- reference to any special installation equipment needed,
- identification of the manufacturing batch.

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

5 Recommendations concerning packaging, transport and storage.

Each cartridge of resin is marked with the identifying mark of the producer, the trade name, the charge code, storage life, curing and processing time.

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

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

The original French version is signed by

Le Directeur Technique
C. BALOCHE

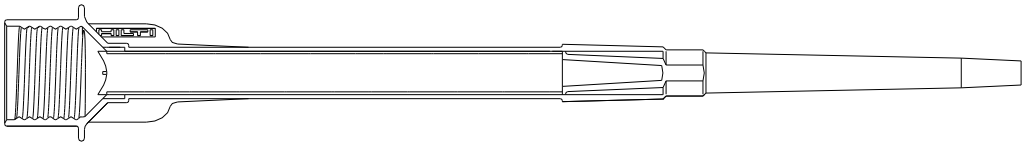
Product description and intended use

The post-installed rebar connection consists of injection mortar Hilti HIT-HY 150 MAX and an embedded straight deformed reinforcing bar with properties of class B and C according to Annex C of EC2 or the Hilti tension anchor HZA-R.

Injection mortar HIT-HY 150 MAX:

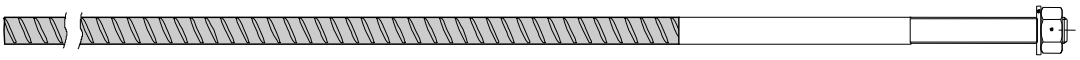
Foil pack:
330 ml, 500 ml und 1400 ml

Static mixer Hilti HIT-RE-M:



Reinforcing bar according to EC2 (see Annex 4):

Hilti Tension anchor HZA-R (see Annex 6):



Covered are post-installed rebar connections in non-carbonated concrete on the assumption only that the design of post-installed rebar connections is done in accordance to EC2.

Installation in dry or wet concrete, it must not be installed in flooded holes

Temperature range: -40°C to +80°C
(maximum long term temperature +50 °C and maximum short term temperature +80 °C)

Injection System Hilti HIT-HY 150 MAX for rebar connection	**Annex 1** **of the European Technical Approval** **ETA - 08/0202**
Product description and intended use	

Figure 1: Overlap joint for rebar connections of slabs and beams

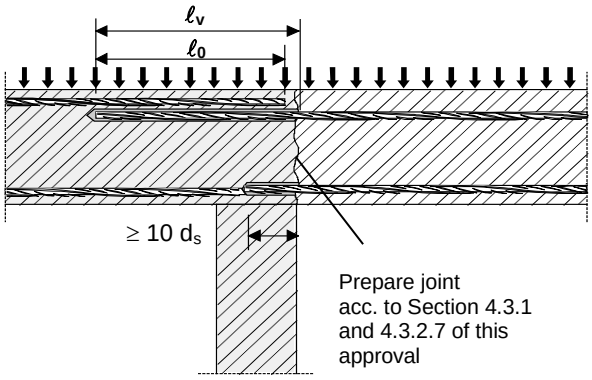


Figure 2: Overlap joint at a foundation of a column or wall where the rebars are stressed in tension

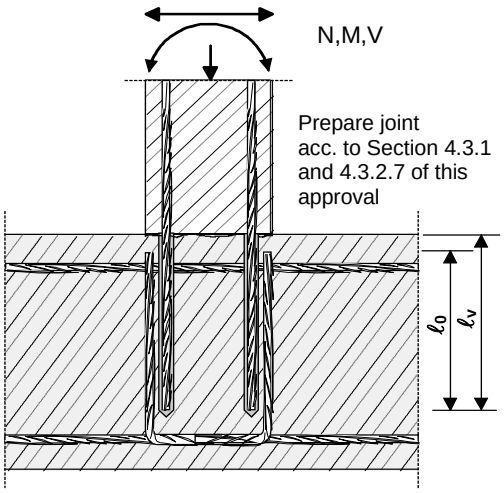


Figure 3: End anchoring of slabs or beams, designed as simply supported

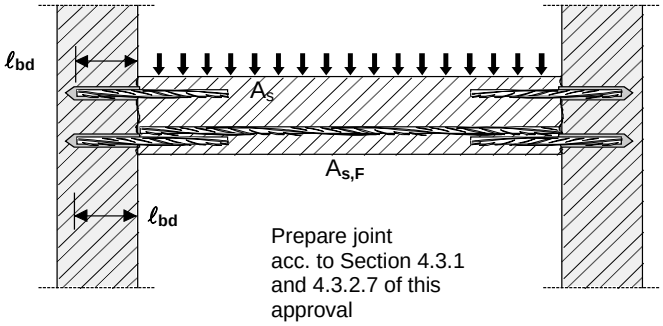


Figure 4: Rebar connection for components stressed primarily in compression. The rebars are stressed in compression.

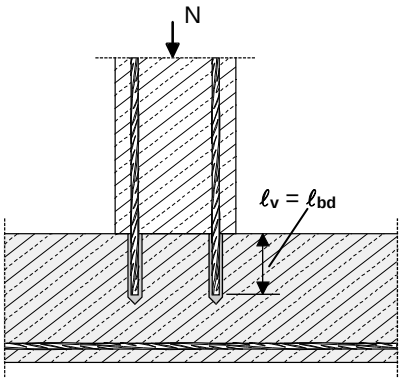
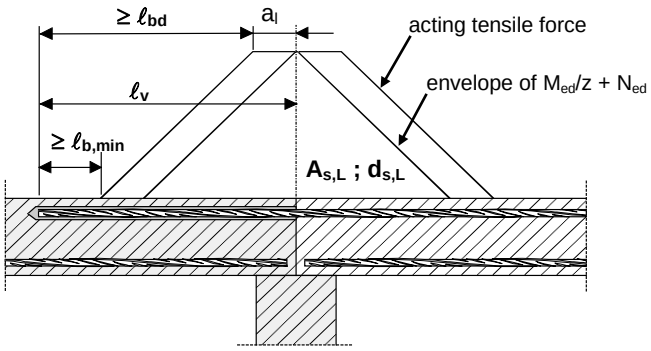


Figure 5: Anchoring of reinforcement to cover the line of acting tensile force



Note to Figure 1 to 5:

In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by EC 2 shall be present.

The shear transfer between old and new concrete shall be designed according to EC 2.

Description of the bonded-in rebars and overlap joints see Annex 4 and 5.

Injection System Hilti HIT-HY 150 MAX for rebar connection	**Annex 2** **of the European Technical Approval** **ETA - 08/0202**
Examples of use for rebars	

Figure 6: Overlap joint of a column stressed in bending to a foundation

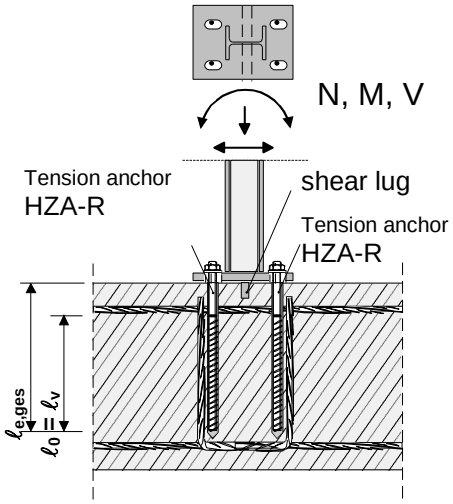


Figure 7: Overlap joint for the anchorage of barrier posts

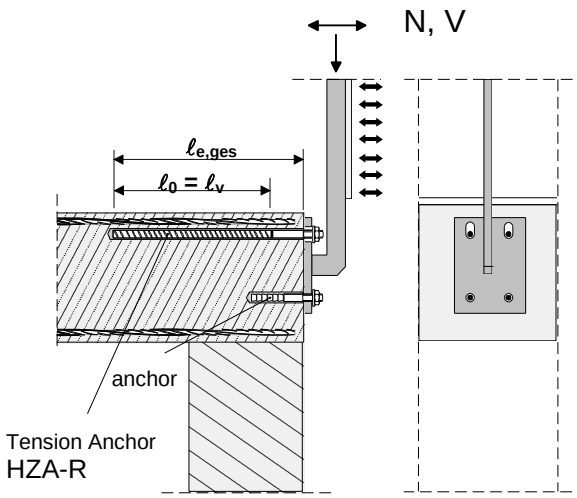
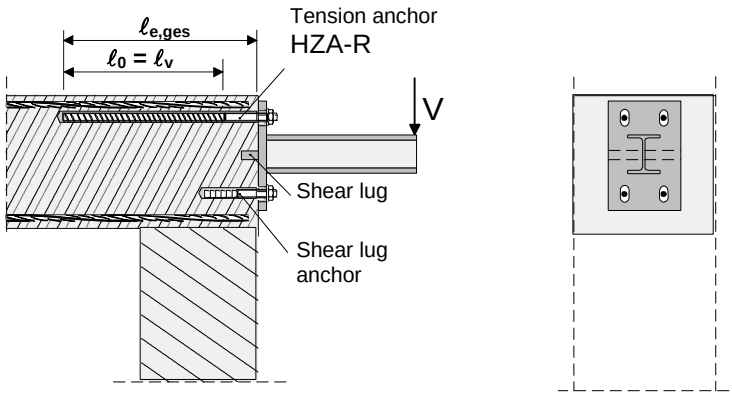


Figure 8: Overlap joint for the anchorage of cantilever members



Note to Figure 6 to 8:

In the figures no transverse reinforcement is plotted. The transverse reinforcement as required by EN 1992-1-1 shall be present.

Only tension forces in the direction of the bar axis may be transmitted by the tension anchor HZA-R.

The tension force must be transferred via an overlap joint to the reinforcement in the building part.

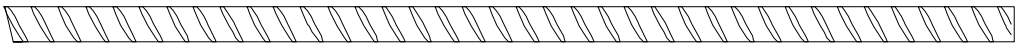
The transmission of the shear load shall be ensured by appropriate additional measures,
e.g. by shear lugs or by anchors with an European technical approval (ETA).

In the anchor plate, the holes for the tension anchor shall be executed as elongated holes with the axis in the direction of the shear force.

Description of anchorages and overlap joints see Annex 5 and 7

Injection System Hilti HIT-HY 150 MAX for rebar connection	**Annex 3** **of the European Technical Approval** **ETA - 08/0202**
Examples of use for tension anchor HZA-R	

Figure 9: Reinforcing bar “rebar” according to EC2



Refer to EOTA TR 023:
This Technical Report covers post-installed rebar connections in non-carbonated concrete under the assumption only that the design of post-installed rebar connections is done in accordance with EN 1992-1-1.

Covered are rebar anchoring systems consisting of bonding material and an embedded straight deformed reinforcing bar with properties according to Annex C of EN 1992-1-1; the classes B and C of the rebar are recommended.

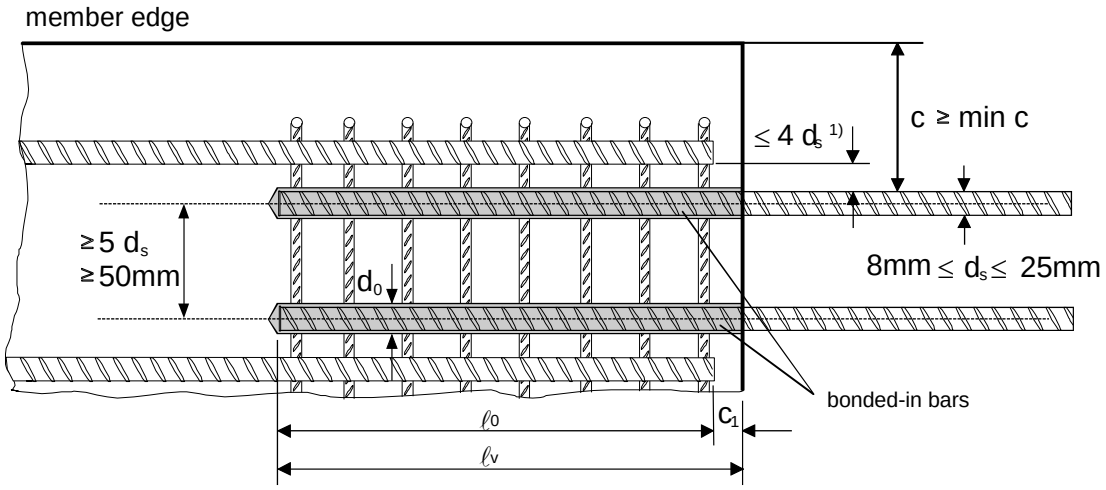
Refer to EN 1992-1-1 Annex C Table C.1 and C.2N Properties of reinforcement:

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 or wire) (%)	Nominal bar size (mm) ≤ 8 > 8	 ± 6,0 ± 4,5	
Bond: Minimum relative rib area, $f_{R,min}$	Nominal bar size (mm) 8 to 12 > 12	 0,040 0,056	

Rip height h:

The maximum outer rebar diameter over the rips shall be:
nominal diameter of the bar $d + 2 * h$ ($h \leq 0,07 * d$)

Figure 10: General design rules of construction for bonded-in rebars



1) If the clear distance between lapped bars exceeds $4d_s$, then the lap length shall be increased by the difference between the clear bar distance and $4d_s$.

The following applies to Figure 10:

- ℓ_v or. ℓ_0 are in accordance with section 4.3.2 of the approval
- The provision of sufficient transverse reinforcement according to section 4.3.2.6 of this approval must be verified.

c	concrete cover of bonded-in bar
c_1	concrete cover at end-face of bonded-in bar
min c	minimum concrete cover acc. Annex 8 of this approval
d_s	diameter of bonded-in bar
ℓ_0	lap length
ℓ_v	effective embedment depth
d_0	nominal drill bit diameter, see Annex 15

Figure 11: Tension anchor HZA-R

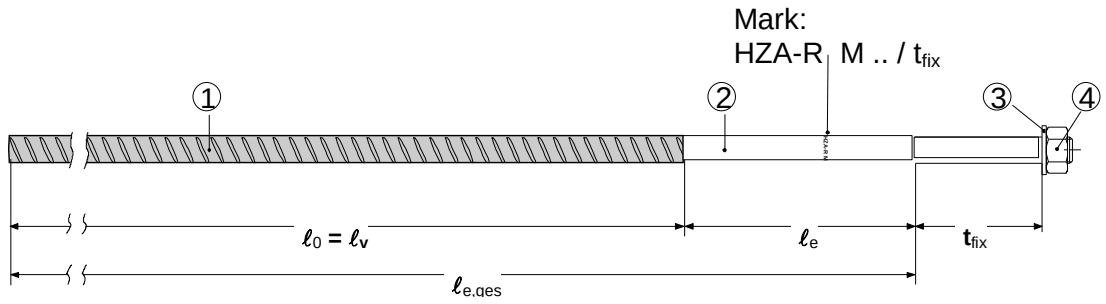


Table 1: Tension anchor HZA-R materials

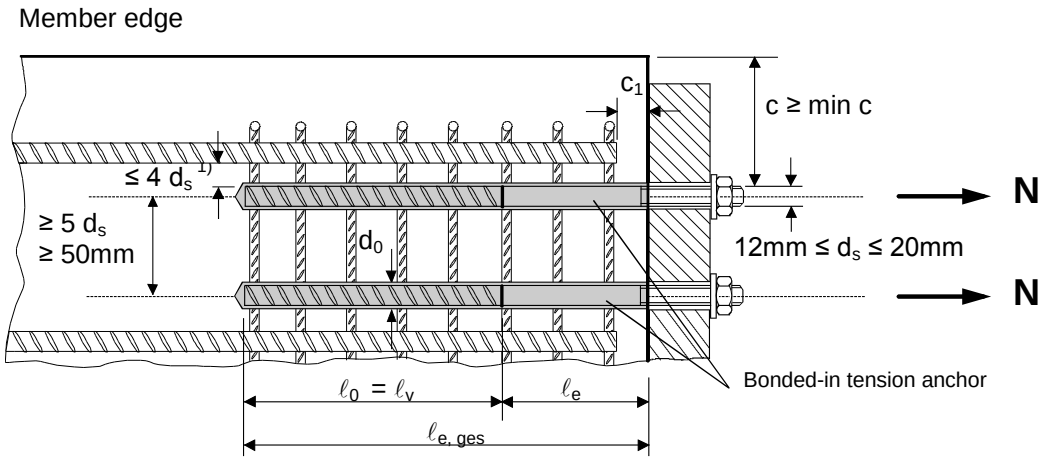
Part	Designation	Material HZA-R			
		M12	M16	M20	M24
1	Reinforcement bar characteristic yield strength $f_{0,2k}$ [MPa]	carbon steel			
		500	500	500	460
2	Round steel smooth with thread	Stainless steel, 1.4404, 1.4571, 1.4362 EN 10088			
3	Washer	Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088			
4	Hex nut	Strength class 70 EN ISO 3506-2 Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088			

Table 2: Tension anchor HZA-R dimensions

HZA-R		M12 / t_{fix}	M16 / t_{fix}	M20 / t_{fix}	M24 / t_{fix}
Diameter of reinforcement bar	[mm]	12	16	20	25
Width across nut flats SW	[mm]	19	24	30	36
Effective embedment depth $\ell_v \leq$ [1)]	[mm]	800	1300	1300	1300
Length of smooth shaft $\ell_e \geq$	[mm]	100	100	100	100
Max torque moment T_{max}	[Nm]	40	80	150	200
Minimum thickness of fixture t_{fix}	[mm]	5	5	5	5
Maximum thickness of fixture t_{fix}	[mm]	200	200	200	400

[1)] may be shortened according to static calculation

Figure 12: General design rules for the Hilti tension anchor HZA-R



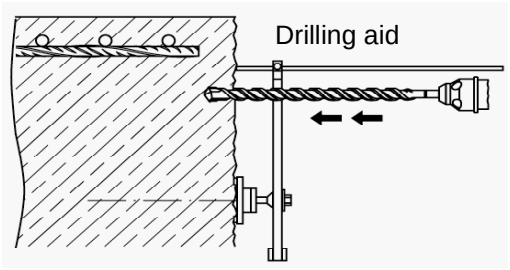
1) If the clear distance between spliced bars exceeds $4d_s$, then the lap length shall be increased by the difference between the clear bar distance and $4d_s$.

The following applies to Figure 12:

- With the tension anchor HZA-R, only tensile forces in the direction of the bar axis may be transmitted.
- ℓ_v or ℓ_0 are in accordance with section 4.3.2 of the approval
- The provision of sufficient transverse reinforcement according to section 4.3.2.6 of this approval must be verified.

c	concrete cover of bonded-in bar
c_1	concrete cover at end-face of bonded-in bar
min c	minimum concrete cover acc. Annex 8 of this approval
d_s	diameter of bonded-in bar
ℓ_0	lap length
ℓ_v	effective embedment depth
ℓ_e	Length of the smooth shaft; $\ell_e \geq 100$ mm
$\ell_{e,ges}$	Embedment depth
d_0	nominal drill bit diameter, see Annex 9

Table 3: Minimum concrete cover min c[1)] of the bonded-in rebar or tension anchor HZA-R depending on drilling method and drilling tolerance



Drilling method	Bar diameter d_s	Without drilling aid	With drilling aid
Hammer drilling **(HD)**	≤ 24 mm	30mm + 0,06 $\ell_v \geq$ 2 d_s	30mm + 0,02 $\ell_v \geq$ 2 d_s
	25 mm	40mm + 0,06 $\ell_v \geq$ 2 d_s	40mm + 0,02 $\ell_v \geq$ 2 d_s
Compressed air drilling **(CA)**	≤ 24 mm	50mm + 0,08 ℓ_v	50mm + 0,02 ℓ_v
	25 mm	60mm + 0,08 ℓ_v	60mm + 0,02 ℓ_v

1) See Figures 10 and 12 (Annex 5 and 7). The minimum concrete cover according to EN 1992-1-1 must be observed.

Table 4: Minimum anchorage length[1)] and lap splice length for C20/25 and maximum installation length l_{max} for good bond conditions

Rebar		Drilling method **HD, CA**		
Ø d_s	$f_{y,k}$ [N/mm²]	$l_{b,min}$ [mm]	$l_{0,min}$ [mm]	l_{max} [mm]
8 mm	500	113	200	1000
10 mm	500	142	200	1000
12 mm	500	170	200	1000
14 mm	500	198	210	1000
16 mm	500	227	240	1500
18 mm	500	255	270	2000
20 mm	500	284	300	2000
22 mm	500	312	330	2000
24 mm	500	340	360	2000
25 mm	500	354	375	2000

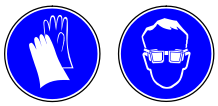
1) according to EN 1992-1-1: $l_{b,min}$ (8.6) and $l_{0,min}$ (8.11) with maximum yield stress for rebar BSt 500S, γ_M = 1,15 and α_6 = 1,0

Table 5: Design values of the ultimate bond resistance f_{bd}[1)] in N/mm² for all drilling methods for good bond conditions

Rebar-Ø	Concrete class								
d_s	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 to 24 mm	1,6	2,0	2,3	2,7	3,0	3,4	3,4	3,4	3,7
25 mm	1,6	2,0	2,3	2,7	3,0	3,4	3,7	3,7	3,7

1) Tabulated values for f_{bd} are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions multiply the values for f_{bd} by 0.7.

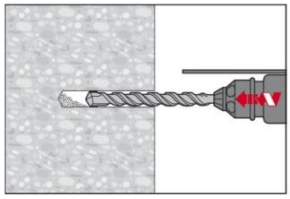
Injection System Hilti HIT-HY 150 MAX for rebar connection	**Annex 8**
Minimum concrete cover min c, minimum anchorage and lap splice length, maximum installation length and design values of the ultimate bond resistance	**of the European Technical Approval** **ETA - 08/0202**

Safety Regulations: 	**Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling!** **Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-HY 150 MAX.**

Important: Observe the Instructions for Use provided with each foil pack.

1. Drill hole

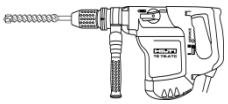
Note: Before drilling, remove Carbonized Concrete; Clean contact areas (see section 4.3.2.7 in ETA)



Or drill hole to the required embedment depth using a hammer-drill with carbide drill bit set in rotation hammer mode, a compressed air drill or a diamond coring machine.

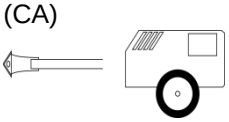
Drill bit size for:

Hammer drill (HD)



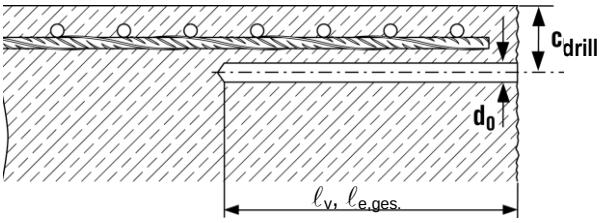
see table 6

Compressed air drill (CA)



see table 6

Splicing applications:

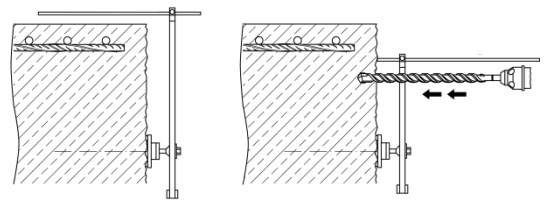


- Measure and control concrete cover c
- $c_{drill} = c + d_s/2$
- Drill parallel to surface edge and to existing rebar
- Where applicable use Hilti drilling aid HIT-BH.

Drilling aid

Example: HIT-BH

1) 2)



For holes ℓ_b > 20 cm use drilling aid (see also table 3 in Annex 8). Three different options can be considered:

A) Hilti drilling aid HIT-BH
B) Slat or spirit level
C) Visual check

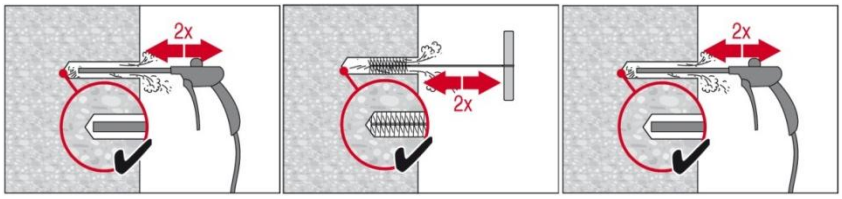
Injection System Hilti HIT-HY 150 MAX for rebar connection	**Annex 9** **of the European Technical Approval** **ETA - 08/0202**
Installation instruction I **Drill hole**	

2. Clean hole

The borehole must be free of dust, debris, water, ice, oil, grease and other contaminants prior to mortar injection. Inadequate borehole cleaning = poor load values.

Just before setting an rebar the hole must be cleaned of dust and debris by one of the two cleaning methods described below:

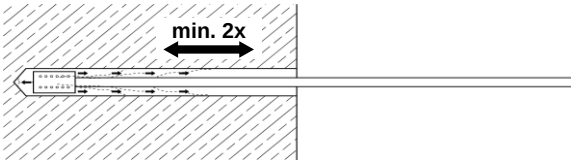
2.1 Compressed air cleaning:



- **Blowing 2 times** from the back of the hole with oil-free compressed air (min. 6 bar at 100 litres per minute (LPM)) until return air stream is free of noticeable dust.
  Bore hole diameter ≥ 32 mm the compressor must supply a minimum air flow of 140 m³/hour.
- **Brushing 2 times** with the specified brush size HIT-RB (brush Ø ≥ borehole Ø) by inserting the round steel brush to the back of the hole in a twisting motion. The brush shall produce natural resistance as it enters the anchor hole. If this is not the case, please use a new brush or a brush with a larger diameter.
- **Blowing 2 times** again with compressed air until return air stream is free of noticeable dust.

If required use additional accessories and extensions for air nozzle and brush to reach back of hole.

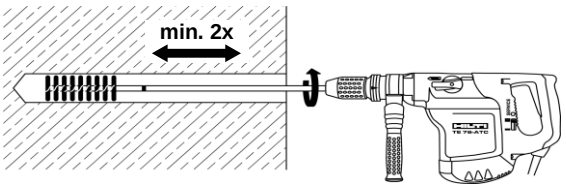
Deep Boreholes – Blowing



For boreholes deeper than 250mm (for d_s=8mm-12mm) resp. deeper than 20xd_s (for d_s>12mm) use the appropriate air nozzle Hilti HIT-DL (see table 6).

Safety tip: Do not inhale concrete dust.
The application of the Hilti HIT-DRS dust collector is recommended.

Deep boreholes – brushing



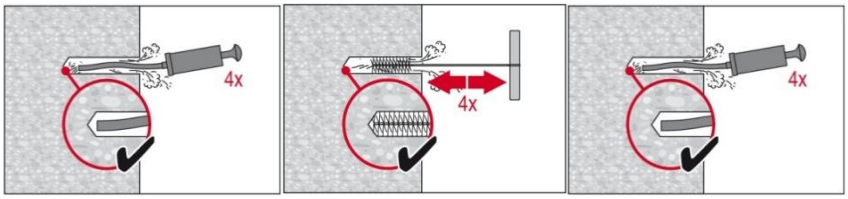
For boreholes deeper than 250mm (for ds=8mm-12mm) resp. deeper than 20xds (for ds>12mm) use machine brushing and brush extensions HIT-RBS (see table 6).

Safety Tips:

- Start machine brushing operation slowly.
- Start brushing operation once brush is inserted in borehole.

Screw the round steel brush HIT-RB in one end of the brush extension(s) HIT-RBS, so that the overall length of the brush is sufficient to reach the base of the borehole. Attach the other end of the extension to the TE-C/TE-Y chuck.
The diameter of the round steel brush shall be checked before use. The minimum brush diameter has to be at least equal to the borehole diameter d_0. The round steel brush shall produce natural resistance as it enters the drill hole. If this is not the case, please use a new brush or a brush with a larger diameter.

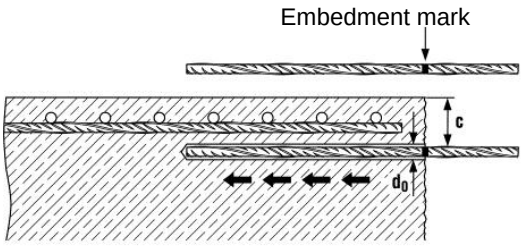
2.2 Manual cleaning: The borehole must be free of dust, debris, water, ice, oil, grease and other contaminants prior to mortar injection. Inadequate borehole cleaning = poor load values.



As an alternative to compressed air cleaning, manual cleaning is permitted for hammer drilled boreholes up to hole diameters d_0 ≤ 20mm and depths ℓ_v resp. $\ell_{e,ges.}$ ≤ 250mm.

- **Blowing** - 4 strokes with Hilti blow-out pump from the back of the hole until return air stream is free of noticeable dust.
- **Brushing** - 4 times with the specified brush size (brush diameter ≥ borehole diameter d_0) by inserting the round steel wire brush to the back of the hole with a twisting motion.
- **Blowing** - 4 strokes with Hilti blow-out pump from the back of the hole until return air stream is free of noticeable dust.

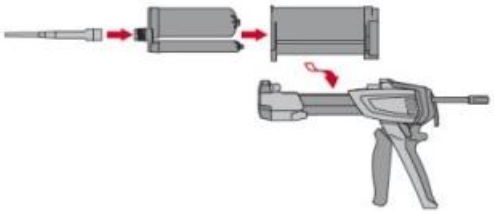
3. Rebar preparation and foil pack preparation



Before use, make sure the rebar is dry and free of oil or other residue.

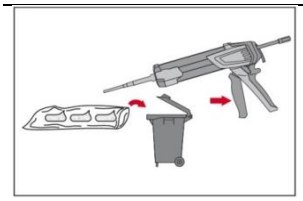
Mark the embedment depth on the rebar (e.g. with tape) → ℓ_v

Insert Rebar in borehole, to verify hole and setting depth ℓ_v resp. $\ell_{e,ges}$



Injection system preparation.
- Observe the Instruction for Use of the dispenser.
- Observe the Instruction for Use of the mortar.
- Tightly attach Hilti HIT-RE-M mixing nozzle to foil pack manifold.
- Insert foil pack into foil pack holder and swing holder into the dispenser.

- **Check Expiration date**: See imprint on manifold (Month/Year). Do not use an expired product!
- **Foil pack temperature**: Must be between 0°C and +40°C when in use.
- **Base material temperature at time of installation**: Must be between -10°C and +40°C.
- **Base material temperature ≥ +30°C**: Cool foil pack to approx. +15°C to + 20°C before injection.
- **Instructions for transport and storage**: Keep in a cool, dry and dark place. +5˚C to +25˚C.

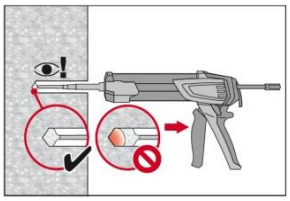


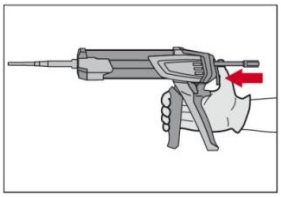
330ml 2 trigger pulls
500ml 3 trigger pulls
<5°C 4 trigger pulls
1400ml 45ml

Discard initial mortar. The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of mortar has to be discarded.
After changing a mixing nozzle, the first few trigger pulls must be discarded as described above. For each new foil pack a new mixing nozzle must be used.

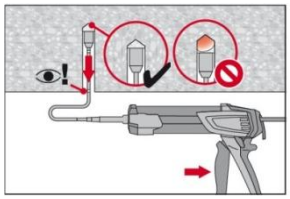
Injection System Hilti HIT-HY 150 MAX for rebar connection	**Annex 11** **of the European Technical Approval** **ETA - 08/0202**
Installation instruction III **Manual cleaning** **Foil pack preparation**	

4. Inject mortar into borehole without forming air pockets.



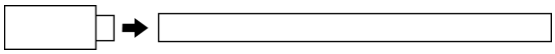


- **Injection method for borehole depth ≤ 250 mm:**
  Inject the mortar from the back of the hole towards the front and slowly withdraw the mixing nozzle step by step after each trigger pull.
  Important! Use extensions for deep holes (> 250 mm). Fill holes approximately 2/3 full, or as required to ensure that the annular gap between the rebar and the concrete is completely filled with adhesive over the embedment length. After injecting, depressurize the dispenser by pressing the release trigger. This will prevent further mortar discharge from the mixing nozzle.
  Maximum embedment depth see Table 6 and Table 7



- **Piston plug injection for borehole depth > 250 mm or overhead applications:** Assemble mixing nozzle, extension(s) and appropriately sized piston plug (see table 6 and 7).
  Insert piston plug to back of the hole. Begin injection allowing the pressure of the injected adhesive mortar to push the piston plug towards the front of the hole. After injecting, depressurize the dispenser by pressing the release trigger. This will prevent further mortar discharge from the mixing nozzle.
  The proper injection of mortar using a piston plug HIT-SZ prevents the creation of air pockets. The piston plug must be insertable to the back of the borehole without resistance. During injection the piston plug will be pressed towards the front of the borehole slowly by mortar pressure. Attention! Pulling the injection or when changing the foil pack, the piston plug is rendered inactive and air pockets may occur.

Piston plug HIT-SZ Injection extension



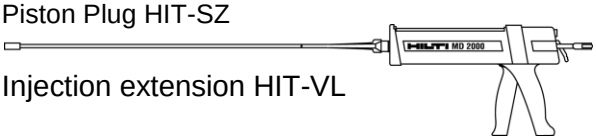
Connect the selected piston plug with the appropriate injection extension.
HIT-SZ 12 with HIT-VL 9/1,0
HIT-SZ 14 – HIT-SZ 18 with HIT-VL 11/1.0
≥ HIT-SZ 18 with HIT-VL 16 or HIT-VL 16/0,7

Please use injection extensions HIT-VL and piston plug HIT-SZ as required.
The combination of HIT-SZ piston plug with HIT-VL 16 pipe and then HIT-VL 16 tube support proper injection.
Deeper embedment depths: For combinations of several injection extensions use coupler HIT-VL K.

A substitution of the injection extension for a plastic hose or a combination of both is permitted.

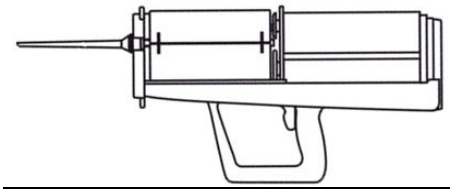
Injection System Hilti HIT-HY 150 MAX for rebar connection	**Annex 12** **of the European Technical Approval** **ETA - 08/0202**
Installation instruction IV **Mortar injection**	

Piston Plug HIT-SZ



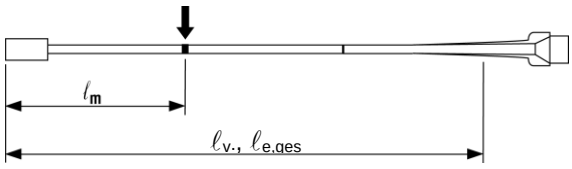
Injection extension HIT-VL

Hilti HIT-MD 2000 Manual dispenser (330 ml)
Hilti HIT-MD 2500 Manual dispenser (500 ml)
Hilti HDM 330 Manual dispenser (330 ml)
Hilti HDM 500 Manual dispenser (500 ml)
Hilti HIT-ED 3500 Electric dispenser (330 / 500 ml)
Hilti HDE 500-A22 Electric dispenser (500 ml)
Hilti HIT-P3000HY Pneumatic dispenser (330 ml)
Hilti HIT-P3500F Pneumatic dispenser (500 ml)



Hilti HIT-P8000D Pneumatic dispenser (1400 ml)

Mortar level mark



$$\ell_m = \ell_v \text{ resp. } \ell_{e,ges} \times \left(1{,}2 \times \frac{d_s^2}{d_0^2} - 0{,}2\right) \quad [mm]$$

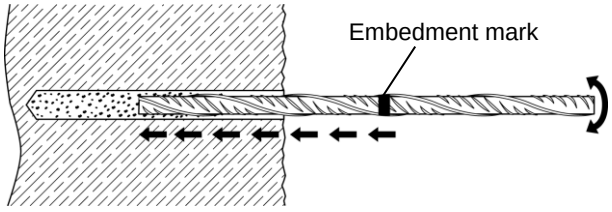
Mark the required mortar level ℓ_m and embedment depth ℓ_b resp. $\ell_{e,total}$ with tape or marker on the injection extension.

Quick estimation: $\ell_m = 1/3 \cdot \ell_v$ resp. $\ell_m = 1/3 \cdot \ell_{e,ges}$

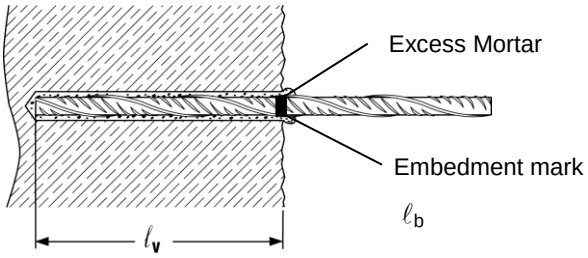
When using a piston plug HIT-SZ continue injection until the mortar level mark ℓ_m becomes visible.

Precise formula for optimum mortar volume:

5. Insert rebar into borehole to the required embedment depth



To ease installation insert the rebar with light rotation into borehole until the embedment mark is at the concrete surface level.

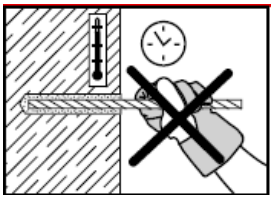


After installing the rebar the annular gap must be completely filled with adhesive mortar.

Proper installation

- Desired anchoring embedment is reached ℓ_b: Embedment mark at concrete surface.
- Excess mortar flows out of the borehole after the rebar has been fully inserted until the embedment mark.
- Overhead application: Support the rebar and secure it from falling till mortar started to harden.

Injection System Hilti HIT-HY 150 MAX for rebar connection	**Annex 13** **of the European Technical Approval** **ETA - 08/0202**
Installation instruction V **Mortar injection and dispenser**	



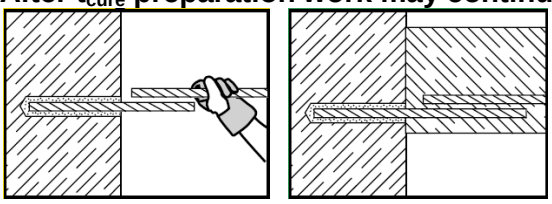
Observe the gel time "t_{gel}", which varies according to temperature of base material. Minor adjustments to the rebar position may be performed during the gel time. See table below. **Do not disturb the rebar** once the working time **"t_{gel}"** has elapsed till "**t_{cure}**".

Base material temperature			Working time "t_{gel}"
-10°C	to	-6°C	180 min
-5°C	to	-1°C	40 min
0°C	to	+4°C	20 min
+5°C	to	+9°C	8 min
+10°C	to	+14°C	7 min
+15°C	to	+19°C	6 min
+20°C	to	+24°C	5 min
+25°C	to	+29°C	3 min
+30°C	to	+40°C	2 min

Maximum gel time "t_{gel}"

Maximum time from the beginning of injection to rebar setting and positioning.

After t_{cure} preparation work may continue.



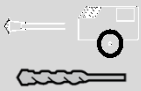
Full load may be applied only after the curing time "t_{cure}" has elapsed. See table below.

Base material temperature			Curing time "t_{cure}"
-10°C	to	-6°C	12 h
-5°C	to	-1°C	4 h
0°C	to	+4°C	2 h
+5°C	to	+9°C	1 h
+10°C	to	+14°C	50 min
+15°C	to	+19°C	40 min
+20°C	to	+24°C	30 min
+25°C	to	+29°C	30 min
+30°C	to	+40°C	30 min

Curing time "t_{cure}"

Before the minimum curing time has elapsed, the rebar may not be loaded.

Table 6: Installation tools for drilling with hammer drill (HD) or compressed air drill (CA)

Elements	Drill and clean					Installation		
Rebar -Ø  d_{nom} [mm]	Hammer drilling **(HD)**  d_0 [mm]	Compressed air drill **(CA)**  d_0 [mm]	Steel brush  HIT-RB	Air Nozzle HIT-DL	Extension for air nozzle 	Piston plug HIT-SZ	Extension for piston plug 	Maximum embed-ment depth l_v or $l_{e,ges}$ [mm]
8	10	-	10	10	HIT-DL 10/0,8 or HIT-DL V10/1	-	HIT-VL 9/1,0	250
	12	-	12	12		12		1000
10	12	-	12	12		12		250
	14	-	14	14		14	HIT-VL 11/1.0	1000
12	14	-	14	14		14		250
	16	-	16	16		16		1000
	-	17	18	16		18		
14	18	17	18	18		18		1000
16	20	-	20	20	HIT-DL 16/0,8 or HIT-DL B and/or HIT-VL 16/0,7 and/or HIT-VL 16	20	HIT-VL 16/0,7 and/or HIT-VL 16	1000
	-	20	22	20		22		
18	22	22	22	22		22		1000
20	25	-	25	25		25		1000
	-	26	28	25		28		
22	28	28	28	28		28		1000
24	32	32	32	32		32		1000
25	32	32	32			32		1000

Assemble extension HIT-VL 16/0.7 with coupler HIT-DL K for deeper anchor holes.

Table 7: Maximum permissible embedment depth [mm] corresponding to dispenser

Rebar	Dispenser	
Ø d_s [mm]	HDM 330, HDM 500, HIT-MD 2000, HIT-MD 2500 HDE 500, HIT-ED 3500, HIT-P3000F, HIT-P3500F	HIT-P8000D
8	70 cm	-
10		
12		100 cm
14		
16		150 cm
18	50 cm	200 cm
20		
22		
24		
25		

Remark:
Injection of mortar at low temperatures is easier and faster when the mortar is heated up slowly to 20°C

Injection System Hilti HIT-HY 150 MAX for rebar connection	**Annex 15**
Installation instruction VII **Installation tools** **Maximum embedment depth per dispenser**	**of the European Technical Approval** **ETA - 08/0202**

Values for pre-calculation of anchoring with Hilti HIT-HY 150 MAX

Examples for the anchorage length[1)] for rebars ($f_{y,k}$ = 500 N/mm²) in C20/25 (f_{bd} = 2,3 N/mm²)

Rebar Ø	$\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=1,0$			α_2 **or** α_5= 0,7 $\alpha_1 = \alpha_3 = \alpha_4 = 1,0$		
	Anchorage length l_{bd}	Tension load	Mortar volume V	Anchorage length l_{bd}	Tension load	Mortar volume V
[mm]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
8	113	6,56	9 (4)**	113	9,37	9 (4)**
	200	11,57	15 (7)**	200	16,53	15 (7)**
	320	18,51	24	-	-	-
	378	21,87	**29**	**265**	21,87	**20**
10	142	10,24	13 (6)**	142	14,63	13 (6)**
	200	14,44	18 (8)**	200	20,63	18 (8)**
	300	21,67	27	300	30,95	27
	400	28,89	36	-	-	-
	473	34,13	**43**	**331**	**34,13**	**30**
12	170	14,74	18 (8)**	170	21,06	18 (8)**
	240	20,79	25 (12)**	240	29,70	25 (12)**
	360	31,19	38	360	44,55	38
	480	41,58	51			
	567	**49,13**	**60**	**397**	**49,13**	**42**
14	198	20,09	24	198	28,70	24
	280	28,34	34	280	40,48	34
	420	42,50	51	420	60,72	51
	560	56,67	68	-	-	-
	662	**66,96**	**80**	**463**	**66,96**	**56**
16	227	26,22	31	227	37,45	31
	320	36,98	43	320	52,83	43
	480	55,48	65	480	79,25	65
	640	73,97	87	-	-	-
	756	**87,39**	**103**	**529**	**87,39**	**72**
18	255	33,13	38	255	47,33	38
	360	46,74	54	360	66,77	54
	540	70,10	81	540	100,15	81
	720	93,47	109	-	-	-
	851	**110,48**	**128**	**595**	**110,35**	**90**
20	284	40,96	60	284	58,51	60
	400	57,78	85	400	82,54	85
	600	86,66	127	600	123,81	127
	800	115,55	170	-	-	-
	945	**136,52**	**200**	**662**	**136,52**	**140**
22	312	49,57	88	312	70,81	88
	440	69,92	124	440	99,89	124
	660	104,88	187	660	149,83	187
	880	139,84	249	-	-	-
	1040	**165,27**	**294**	**728**	**165,27**	**206**
24	340	58,96	144	340	84,22	144
	480	83,17	203	480	118,81	203
	720	124,75	304	720	178,22	304
	960	166,34	405	-	-	-
	1134	**196,48**	**479**	**794**	**196,53**	**335**
25	354	64,04	133	354	91,49	133
	500	90,34	188	500	129,06	188
	750	135,52	282	750	193,59	282
	1000	180,69	376	-	-	-
	1181	**213,48**	**444**	**827**	**213,48**	**311**

1) Tabulated maximum tension loads are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions the values for tension loads must be multiplied by 0.7.

2) The volume V of mortar can be estimated using the equation $V = 1,2*(d_0^2-d^2)*\pi*lb/4$ (** values correspond to min. hole diameter)

Injection System Hilti HIT-HY 150 MAX for rebar connection

Pre-calculated values for the anchorage length with HIT-HY 150 MAX Example for rebars ($f_{y,k}$ = 500 N/mm²) in C20/25 (f_{bd} = 2,3 N/mm²)

Annex 16

of the European Technical Approval

ETA - 08/0202

Values for pre-calculation of lap splice lengths with Hilti HIT-HY 150 MAX
Examples for the lap splice length[1)] for rebars ($f_{y,k}$ = 500 N/mm²) in C20/25 (f_{bd} = 2,3 N/mm²)

Rebar Ø	$\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=\alpha_6=1,0$			α_2 **or** α_5= 0,7 $\alpha_1 = \alpha_3 = \alpha_4 = \alpha_6$= 1,0		
	Lap splice length l_0	Tension load	Mortar volume V	Lap splice length l_0	Tension load	Mortar volume V
[mm]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
8	200	11,57	15 (7)**	200	16,53	15 (7)**
	320	18,51	24	-	-	-
	378	21,87	**29**	**265**	21,87	**20**
10	200	14,44	18 (8)**	200	20,63	18 (8)**
	300	21,67	27	300	30,95	27
	400	28,89	36	-	-	-
	473	34,13	**43**	**331**	**34,13**	**30**
12	200	17,34	21 (10)**	200	24,77	21 (10)**
	240	20,79	25 (12)**	240	29,70	25 (12)**
	360	31,19	38	360	44,55	38
	480	41,58	51			
	567	**49,13**	**60**	**397**	**49,13**	**42**
14	210	21,24	25	210	30,34	25
	280	28,34	34	280	40,48	34
	420	42,50	51	420	60,72	51
	560	56,67	68	-	-	-
	662	**66,96**	**80**	**463**	**66,96**	**56**
16	240	27,75	33	240	39,64	33
	320	36,98	43	320	52,83	43
	480	55,48	65	480	79,25	65
	640	73,97	87	-	-	-
	756	**87,39**	**103**	**529**	**87,39**	**72**
18	270	35,12	41	270	50,17	41
	360	46,74	54	360	66,77	54
	540	70,10	81	540	100,15	81
	720	93,47	109	-	-	-
	851	**110,48**	**128**	**595**	**110,35**	**90**
20	300	43,35	64	300	61,93	64
	400	57,78	85	400	82,54	85
	600	86,66	127	600	123,81	127
	800	115,55	170	-	-	-
	945	**136,52**	**200**	**662**	**136,52**	**140**
22	330	52,46	93	330	74,94	93
	440	69,92	124	440	99,89	124
	660	104,88	187	660	149,83	187
	880	139,84	249	-	-	-
	1040	**165,27**	**294**	**728**	**165,27**	**206**
24	360	62,43	152	360	89,19	152
	480	83,17	203	480	118,81	203
	720	124,75	304	720	178,22	304
	960	166,34	405	-	-	-
	1134	**196,48**	**479**	**794**	**196,53**	**335**
25	375	67,74	141	375	96,71	141
	500	90,34	188	500	129,06	188
	750	135,52	282	750	193,59	282
	1000	180,69	376	-	-	-
	1181	**213,48**	**444**	**827**	**213,48**	**311**

1) Tabulated maximum tension loads are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions the values for tension loads must be multiplied by 0.7.

2) The volume V of mortar can be estimated using the equation $V = 1,2*(d_0^2-d^2)*\pi*l_b/4$ (** values correspond to min. hole diameter)

Injection System Hilti HIT-HY 150 MAX for rebar connection

Pre-calculated values for the lap splice length with HIT-HY 150 MAX Example for rebars ($f_{y,k}$ = 500 N/mm²) in C20/25 (f_{bd} = 2,3 N/mm²)

Annex 17

of the European Technical Approval

ETA - 08/0202