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**Zulassungsstelle für Bauprodukte und Bauarten**
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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)

Deutsches Institut für Bautechnik

DIBt

Mitglied der EOTA
*Member of EOTA*

# European Technical Approval ETA-09/0295

*English translation prepared by DIBt - Original version in German language*

| | |
|---|---|
| Handelsbezeichnung<br>*Trade name* | Injektionssystem Hilti HIT-RE 500-SD für Bewehrungsanschluss<br>*Injection System Hilti HIT-RE 500-SD for rebar connection* |
| Zulassungsinhaber<br>*Holder of approval* | Hilti Aktiengesellschaft<br>Business Unit Anchors<br>9494 Schaan<br>FÜRSTENTUM LIECHTENSTEIN |
| Zulassungsgegenstand und Verwendungszweck<br>*Generic type and use of construction product* | Nachträglich eingemörtelter Bewehrungsanschluss mit Hilti Injektionsmörtel HIT-RE 500-SD<br>*Post-installed rebar connections with Hilti injection mortar HIT-RE 500-SD* |
| Geltungsdauer:<br>*Validity:* | vom *from* 9 May 2013<br>bis *to* 9 May 2018 |
| Herstellwerk<br>*Manufacturing plant* | Hilti Werke |

| | |
|---|---|
| Diese Zulassung umfasst<br>*This Approval contains* | 32 Seiten einschließlich 22 Anhänge<br>*32 pages including 22 annexes* |
| Diese Zulassung ersetzt<br>*This Approval replaces* | ETA-09/0295 mit Geltungsdauer vom 12.10.2012 bis 08.05.2013<br>*ETA-09/0295 with validity from 12.10.2012 to 08.05.2013* |

# 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 Article 2 of the law of 8 November 2011[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 within EOTA. Translations into other languages have to be designated as such.



1 Official Journal of the European Communities L 40, 11 February 1989, p. 12
2 Official Journal of the European Communities L 220, 30 August 1993, p. 1
3 Official Journal of the European Union L 284, 31 October 2003, p. 25
4 *Bundesgesetzblatt Teil I 1998*, p. 812
5 *Bundesgesetzblatt Teil I 2011*, p. 2178
6 Official Journal of the European Communities L 17, 20 January 1994, p. 34

# II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

## 1 Definition of productand intended use

### 1.1 Definition of the construction product

The subject of this approval is the post-installed connection, by anchoring or overlap connection joint, of reinforcing bars (rebars) in existing structures made of normal weight concrete, using the Hilti HIT-RE 500-SD injection mortar in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with a diameter $d_s$ from 8 to 40 mm according to Annex 4 or the Hilti tension anchor HZA-R sizes M12, M16, M20 and M24 according to Annex 6 and Hilti HIT-RE 500-SD injection mortar are used for Hilti rebar connections. The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between embedded element, injection mortar and concrete.

### 1.2 Intended use

The rebar connection may be used in normal weight concrete of a minimum grade of C12/15 and maximum grade C50/60 according to EN 206-1:2000. It may be used in non-carbonated concrete with the allowable chloride content in concrete of 0.40% (CL 0.40) related to the cement content according to EN 206-1.

Rebar connections with reinforcing bars and Hilti tension anchor HZA-R may be used for predominantly static loads.

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

Rebar connections may only be carried out in a manner, which is also possible with cast-in straight reinforcing bars, e.g. those in the following applications (see Annex 2):

- an overlap joint with existing reinforcement in a building component (Figures 1 and 2),
- anchoring of the reinforcement at a slab or beam support, (e.g. according to Figure 3: end support of a slab, designed simply supported, as well as an appropriate general reinforcement for restraint forces),
- anchoring of reinforcement of building components stressed primarily in compression (Figure 4),
- anchoring of reinforcement to cover the envelope line of tensile force in the bending member (Figure 5).

The post-installed rebar connections may be used in the temperature range of -40 °C to +80 °C (max short term temperature +80 °C and max long term temperature +50 °C).

This European technical approval covers anchoring in bore holes made with hammer drilling hollow drilling, compressed air drilling or diamond (dry or wet) drilling technique. The post-installed rebar connection may be installed in dry or wet concrete. It must not be installed in flooded holes.

Rebar connections with the Hilti tension anchor 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. Examples for the application are given in Annex 3, Figures 6 to Figure 8.

- The tension anchor HZA-R made of stainless steel 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).

The provisions made in this European technical approval are based on an assumed working life of the post-installed rebar connection 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 post-installed rebar connection corresponds to the drawings and provisions given in Annexes 1 to 7. The characteristic material values, dimensions and tolerances not indicated in Annexes 1 to 7 shall correspond to the respective values laid down in the technical documentation[7] of this European technical approval.

The two components of the injection mortar are delivered in unmixed condition in foil packs of sizes 330 ml, 500 ml or 1400 ml according to Annex 13. Each foil pack is marked with the identifying mark "HILTI HIT-RE 500-SD" with the production date and expiry date.

The rebar shall comply with the specifications given in Annex 4. The Hilti tension anchor HZA-R shall comply with the specifications given in Annex 6. Each tension anchor with connecting thread made of stainless steel is marked with "HZA-R" according to Annex 6.

### 2.2 Methods of verification

The assessment of fitness of the post-installed 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" and Part 5 "Bonded anchors" and EOTA Technical Report TR 023 "Assessment of post-installed rebar connections"[8].

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.



[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.

[8] The Technical Report TR 023 "Assessment of post-installed rebar connections" is published on EOTA website www.EOTA.eu.

## 3 Evaluation and attestation of conformity and CE marking

### 3.1 System of attestation of conformity

According to the Decision 96/582/EC of the European Commission[9] 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 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.

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 with Deutsches Institut für Bautechnik.[10]

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.



[9] Official Journal of the European Communities L 254 of 08.10.1996

[10] 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.

### 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 injection mortar. 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.

## 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 with 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 Drafting

Rebar connections must be designed in keeping with good engineering practice. Considering the loads to be anchored, design calculations and design drawings must be produced which can be checked. At least the following items must be stated in the design drawings:

- grade of concrete strength,
- diameter, drilling technique, concrete cover, spacing and embedment depth of the rebar,
- length for markings $\ell_m$ and $\ell_v$ respectively $\ell_{e,ges}$ on the injection extension according to Annex 14,

- use of a guide device (drilling aid) for drilling holes close to edges (if necessary),
- kind of preparation of the joint between building component being connected including the diameter and thickness of concrete layer that has to be removed.

## 4.3 Design

### 4.3.1 General

- The actual position of the reinforcement in the existing structure shall be determined on the basis of the construction documentation and taken into account when designing.

The design of post-installed rebar connections according to Annex 2 and determination of the internal section forces to be transferred in the construction joint shall be verified in accordance with EN 1992-1-1:2004. When ascertaining the tensile force in the rebar, allowance shall be made for the statically effective height of the bonded-in reinforcement.

Hilti tension anchor HZA-R according to Annexes 6 and 7 shall be designed for the welded-on reinforcement steel B500B. The length of the bonded-in smooth shaft made of stainless steel may not be accounted as anchorage.

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

The verification of the transfer of the loads to be anchored to the building component shall be provided.

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

### 4.3.2 Determination of the basic anchorage length

The required basic anchorage length $\ell_{b,rqd}$ shall be determined in accordance with EN 1992-1-1, Section 8.4.3:

$$\ell_{b,rqd} = (d_s / 4) (\sigma_{sd} / f_{bd})$$

with: $d_s$ = diameter of the rebar

$\sigma_{sd}$ = calculated design stress of the rebar

$f_{bd}$ = design value of bond strength according to Annex 9, Table 5 or 6 in consideration of the coefficient related to the quality of bond conditions and of the coefficient related to the bar diameter and of the drilling technique

### 4.3.3 Determination of the design anchorage length

The required design anchorage length $\ell_{bd}$ shall be determined in accordance with EN 1992-1-1, Section 8.4.4:

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

with: $\ell_{b,rqd}$ = according to section 4.3.2

$\alpha_1$ = 1.0 for straight bars

$\alpha_2$ = 0.7…1.0 calculated acc. to EN 1992-1-1, Table 8.2

$\alpha_3$ = 1.0 because of no transverse reinforcement

$\alpha_4$ = 1.0 because of no welded transverse reinforcement

$\alpha_5$ = 0.7…1.0 for influence of transverse pressure acc. to EN 1992-1-1, Table 8.2

$\ell_{b,min}$ = minimum anchorage length acc. to EN 1992-1-1

= max {0.3 $\ell_{b,rqd}$; 10$d_s$; 100 mm} under tension

= max {0.6 $\ell_{b,rqd}$; 10$d_s$; 100 mm} under compression

In case of diamond wet drilling multiply the values by 1.5.

The maximum permissible anchorage depth is given in Annex 18 in relation to the dispenser to be used.

### 4.3.4 Overlap joints

The required design lap length $\ell_0$ shall be determined in accordance with EN 1992-1-1, Section 8.7.3:

$\ell_0 = \alpha_1 \cdot \alpha_2 \cdot \alpha_3 \cdot \alpha_5 \cdot \alpha_6 \ell_{b,rqd} \geq \ell_{0,min}$

with: $\ell_{b,rqd}$ = according to Section 4.3.2

$\alpha_1$ = 1.0 for straight bars

$\alpha_2$ = 0.7…1.0 calculated acc. to EN 1992-1-1, Table 8.2

$\alpha_3$ = 1.0 because of no transverse reinforcement

$\alpha_5$ = 0.7…1.0 for influence of transverse pressure acc. to EN 1992-1-1, Table 8.2

$\alpha_6$ = 1.0…1.5 for influence of percentage of lapped bars relative to the total cross-section area acc. to EN 1992-1-1, Table 8.3

$\ell_{0,min}$ = minimum lap length acc. to EN 1992-1-1

= max {$0.3 \cdot \alpha_6 \ell_{b,rqd}$; $15 d_s$; 200 mm}

In case of diamond wet drilling multiply the values by 1.5.

The maximum permissible anchorage depth is given in Annex 18 in relation to the dispenser to be used.

### 4.3.5 Embedment depth for overlap joints

Overlap joint for rebars:

For calculation of the effective embedment depth of overlap joints the concrete cover at end-face of bonded-in rebar $c_1$ shall be considered (see Annex 5, Figure 10):

$\ell_v \geq \ell_0 + c_1$

with: $\ell_0$ = required lap length acc. to Section 4.3.4 and to EN 1992-1-1

$c_1$ = concrete cover at end-face of bonded-in rebar (see also Annex 5)

If the clear distance between the overlapping rebars is greater than 4 $d_s$ the lap length shall be enlarged by the difference between the clear distance and 4 $d_s$.

Overlap joint for Hilti tension anchor HZA-R:

The effective embedment depth is the same like the lap length $\ell_v = \ell_0$ (see Annex 7, Figure 12).

The total embedment depth $\ell_{e.ges}$ shall be determined as follows (see Annex 7, Figure 12):

$\ell_{e.ges} \geq \ell_0 + \ell_e$

with: $\ell_0$ = required lap length acc. to Section 4.3.4 and to EN 1992-1-1

$\ell_e$ = length of the smooth shaft (see also Annex 7), $\ell_e > c_1$

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

### 4.3.6 Concrete cover

The concrete cover required for bonded-in rebars and Hilti 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.

### 4.3.7 Transverse reinforcement

The requirements of transverse reinforcement in the area of the post-installed rebar connection or of the Hilti tension anchor HZA-R connection shall comply with EN 1992-1-1, Section 8.7.4.

### 4.3.8 Connection joint

The transfer of shear forces between new concrete and existing structure 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.

In case of a carbonated surface of the existing concrete structure the carbonated layer shall be removed in the area of the post-installed rebar connection with a diameter of $d_s$ + 60 mm prior to the installation of the new rebar.

The depth of concrete to be removed shall correspond to at least the minimum concrete cover for the respective environmental conditions in accordance with EN 1992-1-1.

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

## 4.4 Installation

The fitness for use of the post-installed rebar connection can only be assumed if the rebar respectively the Hilti tension anchor HZA-R is installed as follows:

- the installation of post-installed rebar respectively Hilti tension anchor 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 injection system only as supplied by the manufacturer without exchanging the components of the Injection system,
- installation in accordance with the manufacturer's specifications and drawings using the tools indicated in the technical documentation of this European technical approval,
- checks before rebar installation to ensure that the strength class of the concrete in which the post-installed rebar connection 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,
- check the position of the existing rebars (if the position of existing rebars is not known, it shall be determined using a rebar detector suitable for this purpose as well as on the basis of the construction documentation and then marked on the building component for the overlap joint),
- keeping the anchorage depth as specified in the design drawings,
- keeping of concrete cover and spacing as specified in the design drawings,
- 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,
- the drilling and cleaning of the hole and the installation shall be performed only with the equipment specified by the manufacturer according to the manufacturer's installation instructions (see Annexes 10-18), it shall be ensured that this equipment is available on site and it is used,
- during curing of the injection mortar the temperature of the building component must not be less than +5 °C and no more than +40 °C; observing the curing time given in Annex 18.

## 5 Recommendations concerning packaging, transport and storage

### 5.1 Responsibility of the manufacturer

It is in the responsibility of the manufacturer to ensure that the information on the specific conditions according to sections 1 and 2 including Annexes referred to as well as section 4 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,
- diameter of rebar,
- admissible service temperature range,
- curing time of the injection mortar,
- Installation instructions including cleaning of the drill hole,
- reference to any special installation equipment needed,
- identification of the manufacturing batch,

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

### 5.2 Packaging, transport and storage

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

Mortar foil packs with expired shelf life must no longer be used.

Uwe Bender
Head of Department

*beglaubigt:*
Lange

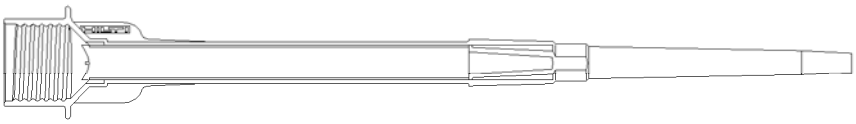
Deutsches Institut für Bautechnik DIBt

## Product description and intended use:

The post-installed rebar connection consists of injection mortar Hilti HIT-RE 500-SD and an embedded straight deformed reinforcing bar with properties of class B and C according to Annex C of EN 1992-1-1 or the Hilti tension anchor HZA-R.

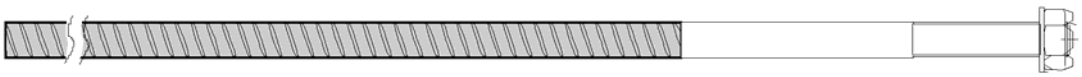
### Injection mortar Hilti HIT-RE 500-SD: Epoxy resin system with aggregate


### Static mixer Hilti HIT-RE-M



### Reinforcing bar (rebar) (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 EC 2.

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

Temperature range: -40 ℃ to +80℃
(maximum long term temperature +50℃ and maximum sh ort term temperature +80℃)

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| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 1** |
| **Product description and intended use** | |

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

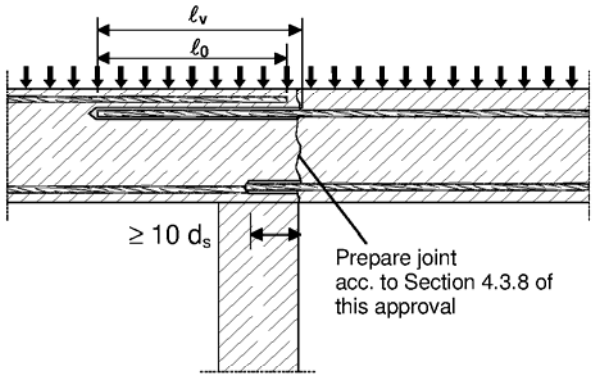



**Figure 2:** Overlap joint at a foundation of a column or wall where the rebars are stressed in tension

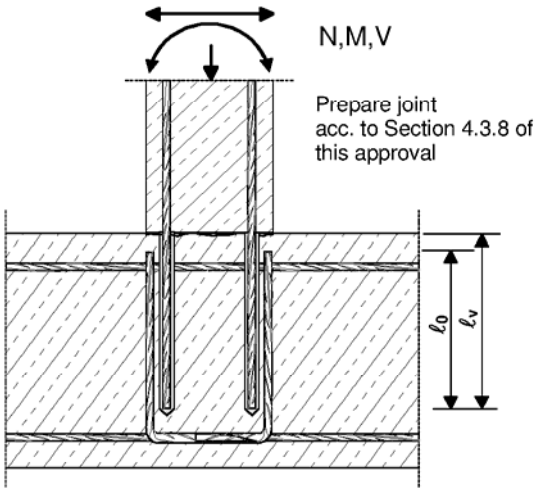



**Figure 3:** End anchoring of slabs or beams, designed as simply supported

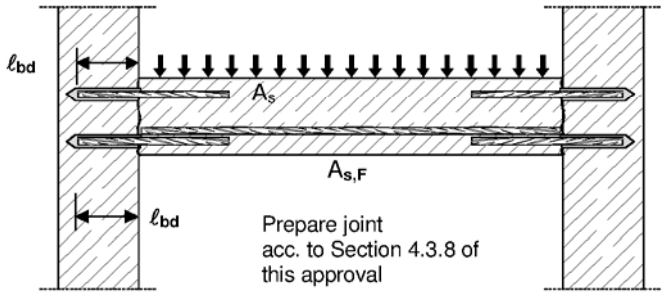



**Figure 4:** Rebar connection for components stressed primarily in compression. The rebars are stressed in compression.

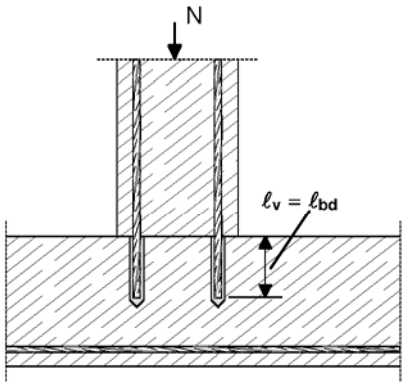
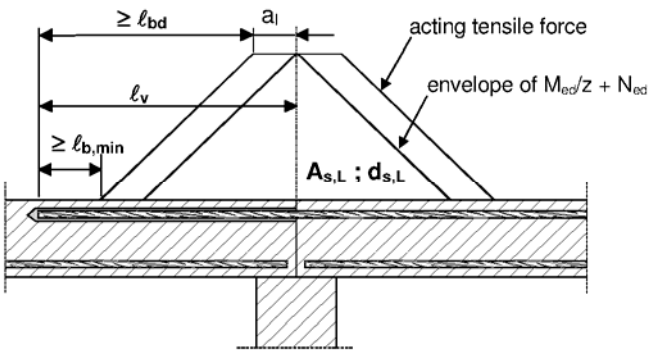



**Figure 5:** Anchoring of reinforcement to cover the line of acting tensile force




**Note to Figure 1 to 5:**

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

The shear transfer between old and new concrete shall be designed according to EN 1992-1-1.

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

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|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 2** |
| **Examples of use for rebars** | |

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

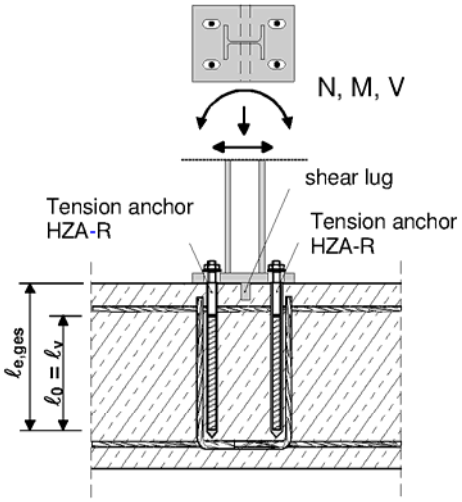



**Figure 7:** Overlap joint for the anchorage of barrier posts

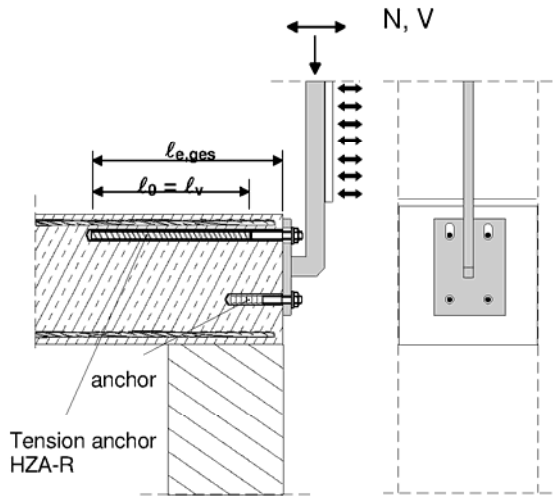
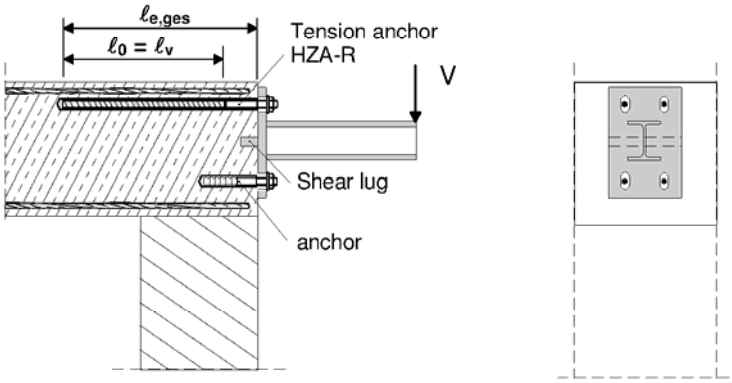



**Figure 8:** Overlap joint for the anchorage of cantilever members




**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 a 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 6 and 7.

| | |
|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 3** |
| **Examples of use for Hilti Tension anchor HZA-R** | |

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## Figure 9: Properties of reinforcing bars "rebars"

**Refer to EN1992-1-1 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<br>< 1,35 |
| Characteristic strain at maximum force, $\varepsilon_{uk}$ (%) | | ≥ 5,0 | ≥ 7,5 |
| Bendability | | Bend / Rebend test | |
| Maximum deviation from nominal mass (individual bar) (%) | Nominal bar size (mm)<br>≤ 8<br>> 8 | <br>± 6,0<br>± 4,5 | |
| Bond: Minimum relative rib area, $f_{R,min}$ (determination according to EN 15630) | Nominal bar size (mm)<br>8 to 12<br>> 12 | <br>0,040<br>0,056 | |

**Rip height h:**

The maximum outer rebar diameter over the rips shall be:
Nominal diameter of the bar d + 2∗h (h ≤ 0,07∗d)



| | |
|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 4** |
| **Description of rebars** | |

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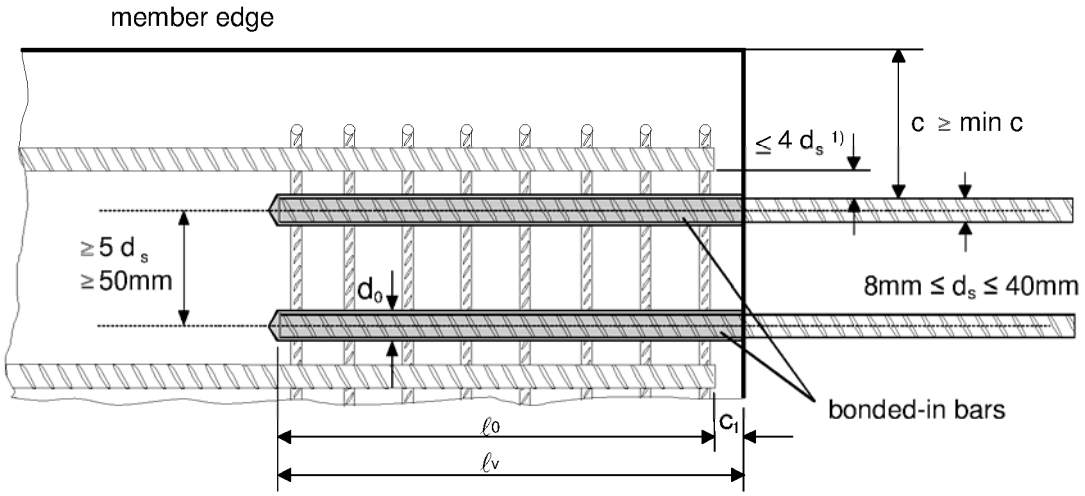
## Figure 10: General design rules of construction for bonded-in rebars




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:

- $\ell_v$ resp. $\ell_0$ are in accordance with Section 4.3.5 respectively with Section 4.3.4 of the approval
- The provision of sufficient transverse reinforcement according to section 4.3.7 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. to Section 4.3.6 of this approval |
| $d_s$ | diameter of bonded-in bar |
| $\ell_0$ | lap length |
| $\ell_v$ | effective embedment depth |
| $d_0$ | nominal drill bit diameter, see Annex 16 and Annex 17 |



| | |
|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 5** |
| **Rebars**<br>**spacing and edge distance and general design rules** | |

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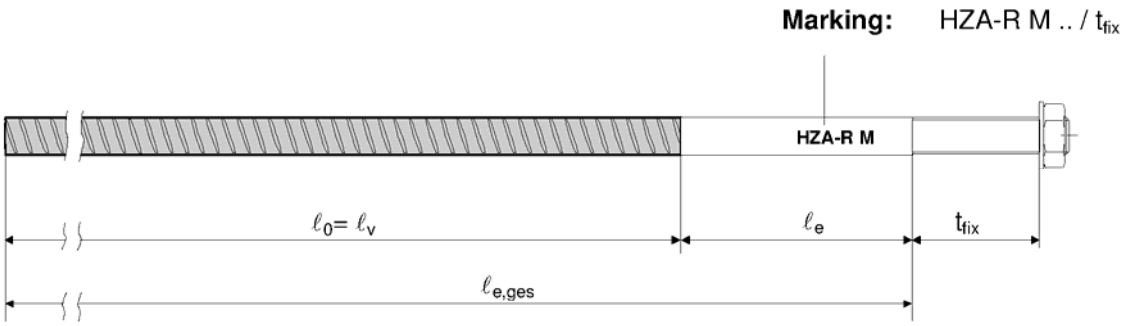
## Figure 11: Tension anchor HZA-R




## Table 1: Hilti tension anchor HZA-R Materials

| Part | Designation | Material HZA-R | | | |
|---|---|---|---|---|---|
| | | M12 | M16 | M20 | M24 |
| 1 | Reinforcement bar<br>Characteristic yield strength $f_{k0,2}$ [N/mm²] | Carbon steel | | | |
| | | 500 | 500 | 500 | 460 |
| 2 | Round steel smooth with thread | stainless steel, 1.4404 and 1.4571, 1.4362, EN 10088 | | | |
| 3 | Washer | stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439 and 1.4362, EN 10088 | | | |
| 4 | Hexagon nut | Strength class 70 EN ISO 3506-2<br>stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439 and 1.4362, EN 10088 | | | |

## Table 2: Hilti tension anchor HZA-R dimensions

| Anchor type / size | | | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|
| Diameter of reinforcement bar | d | [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 | | | |
| Maximum 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

| Injection system Hilti HIT RE 500-SD for rebar connection | Annex 6 |
|---|---|
| Hilti tension anchor HZA-R<br>Dimensions and materials | |

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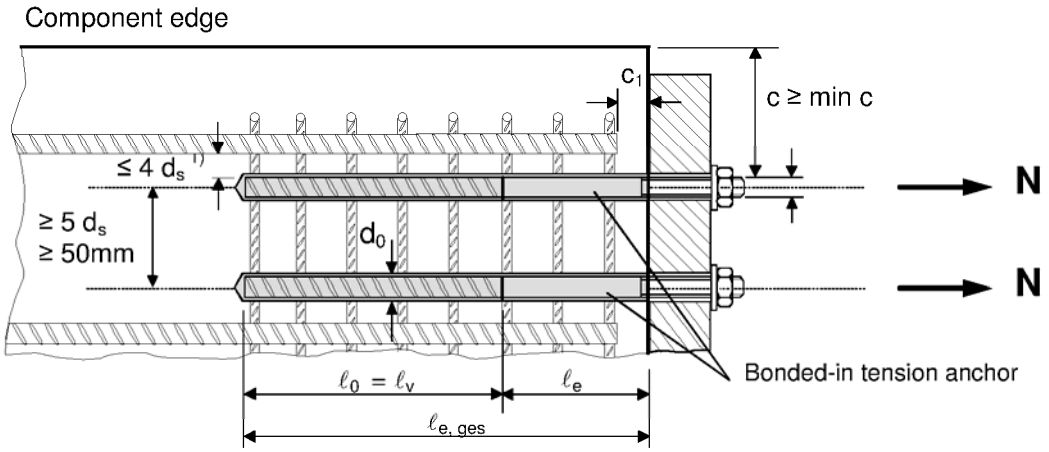
## Figure 12: General design rules for Hilti tension anchor HZA-R




[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.
- $\ell_v$ resp. $\ell_0$ are in accordance with Section 4.3.5 respectively Section 4.3.4 of the approval
- The provision of sufficient transverse reinforcement according to Section 4.3.7 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. to Section 4.3.6 of this approval |
| $d_s$ | diameter of bonded-in bar |
| $\ell_0$ | lap length |
| $\ell_v$ | effective embedment depth |
| $\ell_e$ | length of the smooth shaft; $\ell_e \geq 100$ mm |
| $\ell_{e,ges}$ | total embedment depth |
| $d_0$ | nominal drill bit diameter, see Annex 16 and Annex 17 |



| | |
|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 7** |
| **Hilti tension anchor HZA-R spacing and edge distance and general design rules** | |

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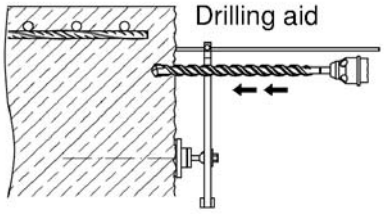
## Table 3: Minimum concrete cover min c [1] of the bonded-in rebar or tension anchor HZA-R depending on drilling method and drilling tolerance




| Drilling method | Bar diameter $d_s$ | Without drilling aid | With drilling aid |
|---|---|---|---|
| Hammer drilling **(HD)** and **(HDB)** [2] | < 25 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)** | < 25 mm | 50mm + 0,08 $\ell_v$ | 50mm + 0,02 $\ell_v$ |
| | ≥ 25 mm | 60mm + 0,08 $\ell_v \geq$ 2 $d_s$ | 60mm + 0,02 $\ell_v \geq$ 2 $d_s$ |
| Diamond coring dry **(PCC)** or wet **(DD)** | < 25 mm | Drill stand is used as drilling aid | 30mm + 0,02 $\ell_v \geq$ 2 $d_s$ |
| | ≥ 25 mm | | 40mm + 0,02 $\ell_v \geq$ 2 $d_s$ |

[1] see Annexes 5 and 7, Figures 10 and 12
[2] HDB = hollow drill bit Hilti TE-CD and TE-YD
Comments: The minimum concrete cover acc. EN 1992-1-1 must be observed

## Table 4: Minimum anchorage lengths and lap lengths for C20/25 and maximum installation length

according to EN 1992-1-1: $l_{b,min}$ (8.6) and $l_{0,min}$ (8.11) for good bond conditions and $\alpha_6$ = 1,0 with maximum yield stress for rebar BSt 500S and $\gamma_M$ = 1,15

| Rebar | | Drilling method **HD, HDB, CA, PCC** | | Drilling method **DD** | | |
|---|---|---|---|---|---|---|
| Ø $d_s$ [mm] | $f_{y,k}$ [N/mm²] | $l_{b,min}$ [mm] | $l_{0,min}$ [mm] | $l_{b,min}$ [mm] | $l_{0,min}$ [mm] | $l_{max}$ [mm] |
| 8 | 500 | 113 | 200 | 170 | 300 | 1000 |
| 10 | 500 | 142 | 200 | 213 | 300 | 1000 |
| 12 | 500 | 170 | 200 | 255 | 300 | 1200 |
| 14 | 500 | 198 | 210 | 298 | 315 | 1400 |
| 16 | 500 | 227 | 240 | 340 | 360 | 1600 |
| 18 | 500 | 255 | 270 | 383 | 405 | 1800 |
| 20 | 500 | 284 | 300 | 425 | 450 | 2000 |
| 22 | 500 | 312 | 330 | 468 | 495 | 2200 |
| 24 | 500 | 340 | 360 | 510 | 540 | 2400 |
| 25 | 500 | 354 | 375 | 532 | 563 | 2500 |
| 26 | 500 | 369 | 390 | 553 | 585 | 2600 |
| 28 | 500 | 397 | 420 | 595 | 630 | 2800 |
| 30 | 500 | 425 | 450 | 638 | 675 | 3000 |
| 32 | 500 | 454 | 480 | 681 | 720 | 3200 |
| 34 | 500 | 482 | 510 | 723 | 765 | 3200 |
| 36 | 500 | 534 | 540 | 800 | 810 | 3200 |
| 40 | 500 | 621 | 621 | 932 | 932 | 3200 |



| | |
|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 8** |
| **Minimum concrete cover**<br>**Minimum anchorage length and maximum installation length** | |

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**Table 5: Design values of the ultimate bond resistance $f_{bd}$ in N/mm² for Hammer drilling (HD) and (HDB), Compressed air drilling (CA) and Diamond coring, dry (PCC)**

according to EN 1992-1-1 for good bond conditions
(for all other bond conditions multiply the values by 0.7)

| Rebar | Concrete class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ø $d_s$ [mm] | C12/15 | C16/20 | C20/25 | C25/30 | C30/37 | C35/45 | C40/50 | C45/55 | C50/60 |
| 8 to 32 | 1,6 | 2,0 | 2,3 | 2,7 | 3,0 | 3,4 | 3,7 | 4,0 | 4,3 |
| 34 | 1,6 | 2,0 | 2,3 | 2,6 | 2,9 | 3,3 | 3,6 | 3,9 | 4,2 |
| 36 | 1,5 | 1,9 | 2,2 | 2,6 | 2,9 | 3,3 | 3,6 | 3,8 | 4,1 |
| 40 | 1,5 | 1,8 | 2,1 | 2,5 | 2,8 | 3,1 | 3,4 | 3,7 | 4,0 |

**Table 6: Design values of the ultimate bond resistance $f_{bd}$ in N/mm² for Diamond coring, wet (DD)**

according to EN 1992-1-1 for good bond conditions
(for all other bond conditions multiply the values by 0.7)

| Rebar | Concrete class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ø $d_s$ [mm] | C12/15 | C16/20 | C20/25 | C25/30 | C30/37 | C35/45 | C40/50 | C45/55 | C50/60 |
| 8 to 25 | 1,6 | 2,0 | 2,3 | 2,7 | 3,0 | 3,4 | 3,7 | 4,0 | 4,3 |
| 26 to 32 | 1,6 | 2,0 | 2,3 | 2,7 | | | | | |
| 34 | 1,6 | 2,0 | 2,3 | 2,6 | | | | | |
| 36 | 1,5 | 1,9 | 2,2 | 2,6 | | | | | |
| 40 | 1,5 | 1,8 | 2,1 | 2,5 | | | | | |



| Injection system Hilti HIT RE 500-SD for rebar connection | Annex 9 |
|---|---|
| Design values of ultimate bond resistance $f_{bd}$ | |

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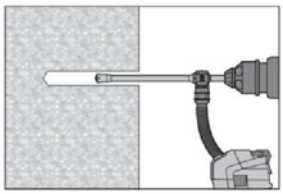
| **Safety Regulations:**  | Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling!<br>Wear well-fitting protective goggles and protective gloves when working with Hilti HIT-RE 500-SD.<br>Important: Observe the Instructions for Use provided with each foil pack |
|---|---|

## 1. Drill hole

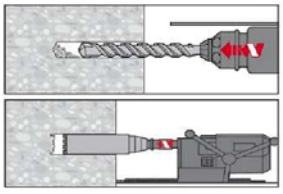
Note: Before drilling, remove carbonized concrete; clean contact areas (see section 4.3.8 in ETA)



Drill hole to the required embedment depth with an appropriately sized Hilti TE-CD or TE-YD hollow drill bit (HDB) with Hilti vacuum attachment. This drilling system removes the dust and cleans the bore hole during drilling when used in accordance with the user's manual.

After drilling is complete, proceed to the "injection preparation" step in the instructions for use.

Drill bit size see Table 8



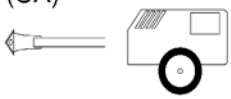
Or drill hole to the required embedment depth using a hammer-drill with carbide drill bit set in rotation hammer mode, a compressed air drill or a diamond coring machine.

Drill bit size for:

Hammer drill (HD)

see Table 7

Compressed air drill (CA)

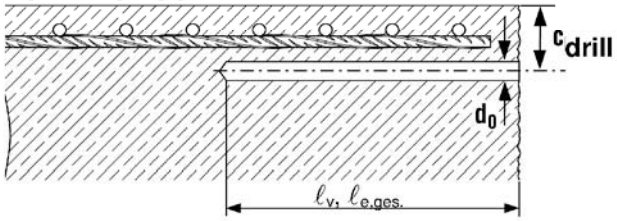


see Table 7

Diamond core wet (DD) and dry (PCC)

see Table 7 and Table 8

## Splicing applications:

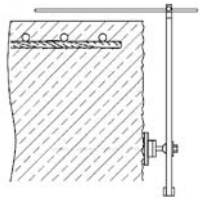



- Measure and control concrete cover c
- $c_{drill} = c + d_s/2$
- Drill parallel to surface edge and to existing rebar
- Where applicable use Hilti drilling aid HIT-BH.

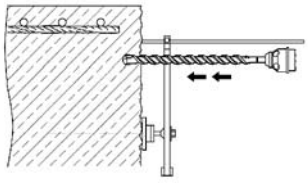
## Drilling aid

Example: HIT-BH

1)



2)



For holes $\ell_b$ > 20 cm use drilling aid.
Three different options can be considered:

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

| Injection system Hilti HIT RE 500-SD for rebar connection | Annex 10 |
|---|---|
| Installation instruction | |

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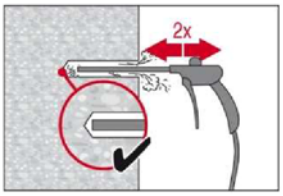
## 2. Clean hole

The borehole must be free of dust, debris, water, ice, oil, grease and other contaminants prior to mortar injection.
(not needed with Hollow Drill Bit (HDB))

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

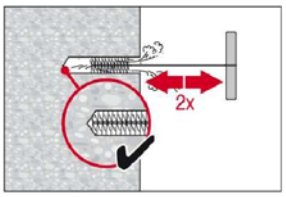
## 2.1. Compressed air cleaning:




**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.

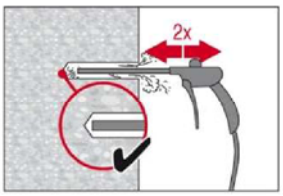
Bore hole diameter ≥ 32 mm the compressor must supply a minimum air flow of 140 m³/hour.




**Brushing**

2 times with the specified brush size (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.

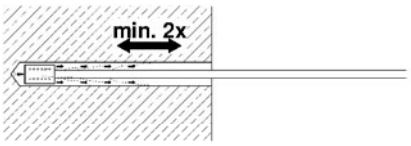
For appropriate brushes HIT-RB see Table 7 and Table 8.




**Blowing**

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

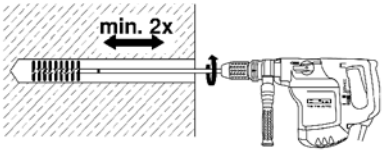
**If required use additional accessories and extensions for air nozzle and brush to reach back of hole.**




**Deep Boreholes – Blowing:**

For boreholes deeper than 250mm (for $d_s$ = 8mm - 12mm) resp. deeper than 20x$d_s$ (for $d_s$>12mm) use the appropriate air nozzle Hilti HIT-DL (see Table 7 and Table 8)

**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 $d_s$ = 8mm - 12mm) resp. deeper than 20x$d_s$ (for $d_s$>12mm) use machine brushing and brush extensions HIT-RBS.

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.

**Safety tip:**

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



| Injection system Hilti HIT RE 500-SD for rebar connection | Annex 11 |
|---|---|
| Installation instruction | |

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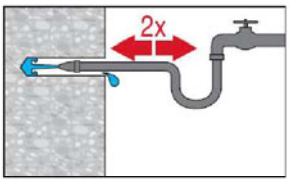
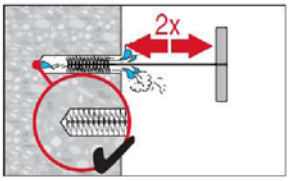
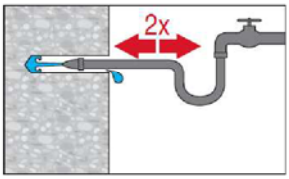
## 2.1. Compressed air cleaning:



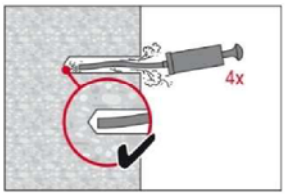

**In addition for wet diamond coring:**

For wet diamond coring please observe the following steps in addition to the compressed air cleaning:

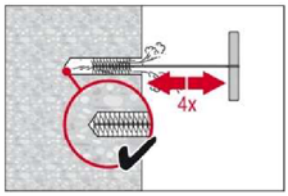
Remove all core fragments from the anchor hole. Flush the anchor hole with clear running water until water runs clear. Brush the anchor hole again 2 times with the appropriate sized brush over the entire depth of the anchor hole. Repeat the flushing process until water runs out of the anchor hole.

## 2.2. Manual cleaning:

Manual cleaning is permitted for hammer drilled boreholes up to hole diameters $d_0 \leq 20$mm and depths $\ell_v$ resp. $\ell_{e,ges.} \leq 250$ mm.

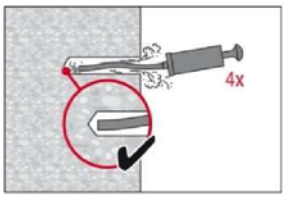



**Blowing**
4 strokes with Hilti blow-out pump from the back of the hole until return air stream is free of noticeable dust.




**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. 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.

For appropriate Brushes HIT-RB see Table 7and Table 8.




**Blowing**
4 strokes with Hilti blow-out pump from the back of the hole until return air stream is free of noticeable dust

**Manual Cleaning:**
Hilti hand pump recommended for blowing out bore holes with diameters $d_0 \leq 20$ mm and bore hole depth $h_0 \leq 250$ mm.



| Injection system Hilti HIT RE 500-SD for rebar connection | Annex 12 |
|---|---|
| Installation instruction | |

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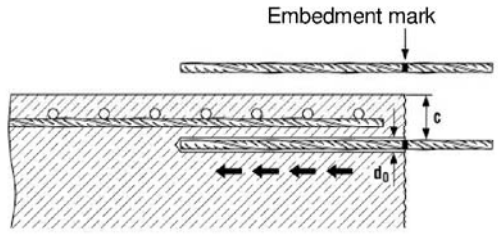
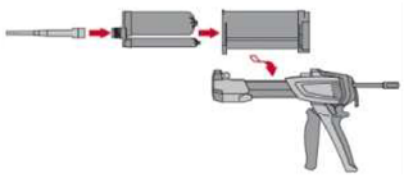
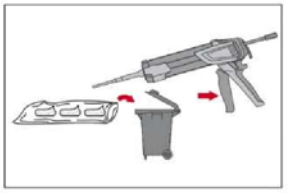
## 3. Rebar preparation and foil pack preparation




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 ) → $\ell_v$
Insert Rebar in borehole, to verify hole and setting depth $\ell_v$ 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 put holder into the dispenser.



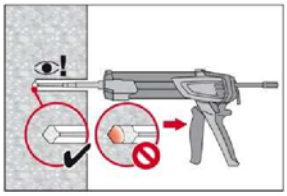
Discard initial adhesive. The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.
After changing a mixing nozzle, the first few trigger pulls must be discarded as described above. For each new foil pack a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

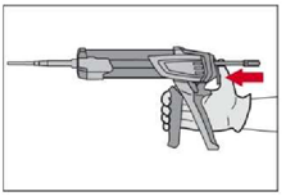
| | |
|---|---|
| 3 strokes | for 330 ml foil pack, |
| 4 strokes | for 500 ml foil pack, |
| 65 ml | for 1400 ml foil pack |

## 4. Inject mortar into borehole

Forming air pockets shall be avoided.

### 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.

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.

| | |
|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 13** |
| **Installation instruction** | |

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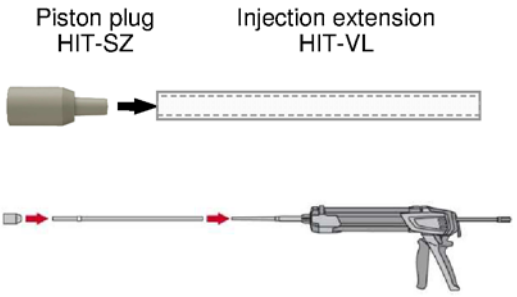
## 4. Inject mortar into borehole

Forming air pockets shall be avoided.

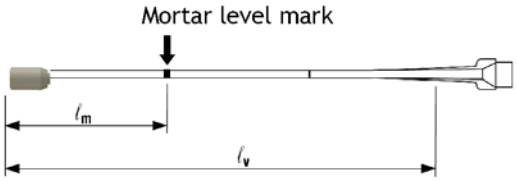
## Injection method for borehole depth > 250 mm or overhead applications:




Assemble mixing nozzle, extension(s) and piston plug HIT-SZ (see Table 7 and Table 8)

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.

The combination of HIT-SZ piston plug with HIT-VL 16 pipe and then HIT-VL 16 tube support proper injection.

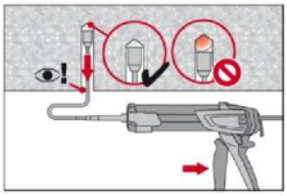


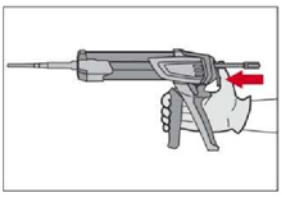

Mark the required mortar level $\ell$m and embedment depth $\ell$b resp. $\ell$e,ges with tape or marker on the injection extension.

A) Estimation: $\ell_m = 1/3 \cdot \ell v$ resp. $\ell_m = 1/3 \cdot \ell_{e,ges}$

B) Precise formula for optimum mortar volume:

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





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.

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.

When the required mortar level was marked continue injection until the mortar level mark $\ell$m becomes visible.

After injecting, depressurize the dispenser by pressing the release trigger. This will prevent further mortar discharge from the mixing nozzle.

Maximum embedment depth for different rebar diameter, drilling methods and dispensers see Table 7, Table 8 and Table 9



| Injection system Hilti HIT RE 500-SD for rebar connection | Annex 14 |
|---|---|
| Installation instruction | |

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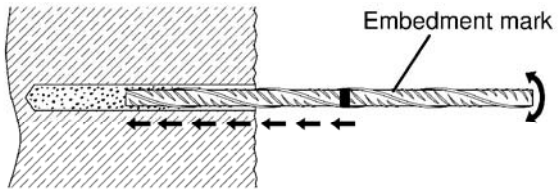
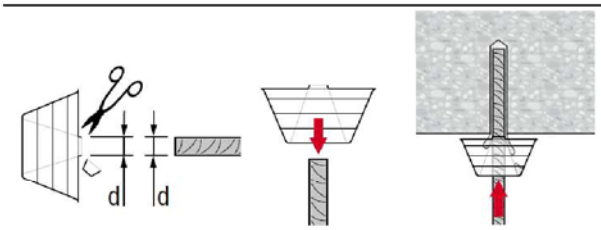
## 5. Insert rebar

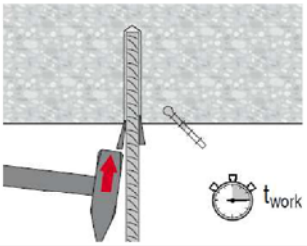



For ease installation insert the rebar slowly twisted into the borehole until the embedment mark is at the concrete surface level.

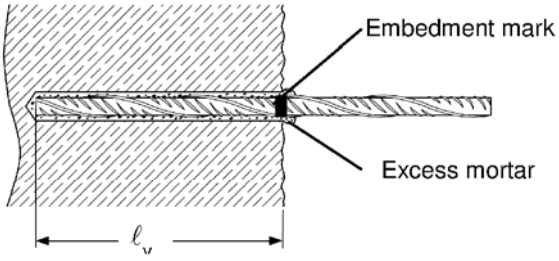



**Overhead application:**

During insertion of the rebar mortar might flow out of the bore hole. For collection of the flowing mortar HIT-OHC may be used.

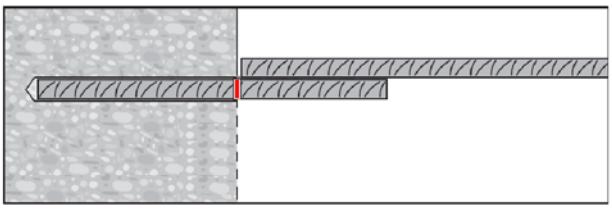



Support the rebar and secure it from falling till mortar started to harden, e.g. using HIT-OHW




After installing the rebar the annular gap must be completely filled with mortar.
Proper installation:

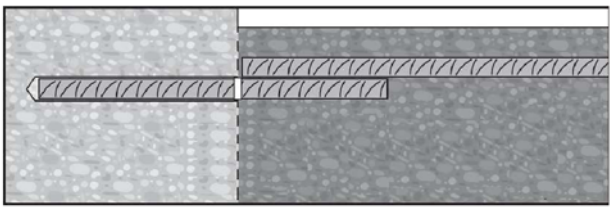
- Desired anchoring embedment is reached ∿: Embedment mark at concrete surface.
- Excess mortar flows out of the borehole after the rebar has been fully inserted until the embedment mark.
- Overhead application: Support the rebar and secure it from falling till mortar started to harden.



Observe the working time "$t_{work}$", which varies according to temperature of base material. Minor adjustments to the rebar position may be performed during the working time

After $t_{cure,ini}$ preparation work may continue.

"$t_{work}$" and "$t_{cure,ini}$" see Table 10.



Full load may be applied only after the curing time "$t_{cure}$" has elapsed (see Table 10).

| | |
|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 15** |
| **Installation instruction** | |

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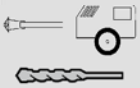
**Table 7: Installation tools for drilling with hammer drill (HD) compressed air drill (CA) or with wet diamond coring (DD)**

| Elements | Drill and clean | | | | | | Installation | | |
|---|---|---|---|---|---|---|---|---|---|
| Rebar -Ø  | Hammer drilling **(HD)**  | Compressed air drill **(CA)**  | Diamond core wet **(DD)**  | Steel brush  | Air Nozzle  | Extension for air nozzle  | Piston plug  | Extension for piston plug  | Maximum embed-ment depth |
| $d_{nom}$ [mm] | $d_0$ [mm] | $d_0$ [mm] | $d_0$ [mm] | HIT-RB | HIT-DL | | HIT-SZ | | $l_v$ or $l_{e,ges}$ [mm] |
| 8 | 10 | - | 10 | 10 | 10 | HIT-DL 10/0,8 or HIT-DL V10/1 | - | HIT-VL 9/1,0 | 250 |
| | 12 | - | 12 | 12 | 12 | | 12 | | 1000 |
| 10 | 12 | - | 12 | 12 | 12 | | 12 | | 250 |
| | 14 | - | 14 | 14 | 14 | | 14 | HIT-VL 11/1.0 | 1000 |
| 12 | 14 | - | 14 | 14 | 14 | | 14 | | 250 |
| | 16 | - | 16 | 16 | 16 | | 16 | | 1200 |
| | - | 17 | - | 18 | 16 | | 18 | | |
| 14 | 18 | 17 | 18 | 18 | 18 | | 18 | | 1400 |
| 16 | 20 | - | 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 | 1600 |
| | - | 20 | - | 22 | 20 | | 22 | | |
| 18 | 22 | 22 | 22 | 22 | 22 | | 22 | | 1800 |
| 20 | 25 | - | 25 | 25 | 25 | | 25 | | 2000 |
| | - | 26 | - | 28 | 25 | | 28 | | |
| 22 | 28 | 28 | 28 | 28 | 28 | | 28 | | 2200 |
| 24 | 32 | 32 | 32 | 32 | 32 | | 32 | | 2400 |
| 25 | 32 | 32 | 32 | 32 | | | 32 | | 2500 |
| 26 | 35 | 35 | 35 | 35 | | | 35 | | 2600 |
| 28 | 35 | 35 | 35 | 35 | | | 35 | | 2800 |
| 30 | - | 35 | 35 | 35 | | | 35 | | 3000 |
| | 37 | - | - | 37 | | | 37 | | |
| 32 | 40 | 40 | 40 | 40 | | | 40 | | 3200 |
| 34 | - | 42 | 42 | 42 | | | 42 | | |
| | 45 | - | - | 45 | | | 45 | | |
| 36 | 45 | 45 | - | 45 | | | 45 | | |
| | - | - | 47 | 47 | | | 47 | | |
| 40 | - | - | 52 | 52 | | | 52 | | |
| | 55 | 57 | - | 55 | | | 55 | | |

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



| | |
|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 16** |
| **Installation tools for drilling with hammer drill (HD), compressed air drill (CA) or with wet diamond coring (DD)** | |

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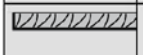
**Table 8: Installation tools for drilling with hollow drill bit (HDB) or with dry diamond coring (PCC) --- no cleaning required**

| **Elements** | **Drill** (no cleaning required) | | | | | **Installation** | | |
|---|---|---|---|---|---|---|---|---|
| Rebar -Ø | Hammer drilling, hollow drill bit **(HDB)** | Diamond coring dry **(PCC)** | Steel brush | Air Nozzle | Extension for air nozzle | Piston plug | Extension for piston plug | Maximum embed-ment depth |
|  |  TE-CD / TE-YD |  |  |  |  |  |  | |
| $d_{nom}$ [mm] | $d_0$ [mm] | $d_0$ [mm] | HIT-RB | HIT-DL | | HIT-SZ | | $l_v$ or $l_{e,ges}$ [mm] |
| 8 | 12 | - | No cleaning required | | | 12 | HIT-VL 9/1,0 | 200 |
| 10 | 12 | - | | | | 12 | | 200 |
| | 14 | - | | | | 14 | HIT-VL 11/1.0 | 240 |
| 12 | 14 | - | | | | 14 | | 240 |
| | 16 | - | | | | 16 | | 400 |
| 14 | 18 | - | | | | 18 | | 400 |
| 16 | 20 | - | | | | 20 | HIT-VL 16/0,7 and/or HIT-VL 16 | 400 |
| 18 | 22 | - | | | | 22 | | 400 |
| 20 | 25 | - | | | | 25 | | 400 |
| 22 | 28 | - | | | | 28 | | 400 |
| 24 | 32 | - | | | | 32 | | 400 |
| | - | 35 | | | | 35 | | 2400 |
| 25 | 32 | - | | | | 32 | | 400 |
| | - | 35 | | | | 35 | | 2500 |
| 26 | - | 35 | | | | 35 | | 2600 |
| 28 | - | 35 | | | | 35 | | 2800 |
| 30 | - | 35 | | | | 35 | | 3000 |
| 32 | - | 47 | | | | 45 | | 3200 |
| 34 | - | 47 | | | | 45 | | 3200 |
| 36 | - | 47 | | | | 45 | | 3200 |
| 40 | - | 52 | | | | 52 | | 3200 |

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



| | |
|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 17** |
| **Installation tools for drilling with hollow drill bit (HDB) or with dry diamond coring (PCC)** | |

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**Table 9: 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-P300F, HIT-P3500F | HIT-P8000D |
| 8 | 1000 | 1000 | - |
| 10 | | | |
| 12 | | 1200 | 1200 |
| 14 | | | 1400 |
| 16 | | 1500 | 1600 |
| 18 | 700 | 1300 | 1800 |
| 20 | | | 2000 |
| 22 | | 1000 | 2200 |
| 24 | | | 2400 |
| 25 | | | 2500 |
| 26 | 500 | 700 | 2600 |
| 28 | | | 2800 |
| 30 | - | | 3000 |
| 32 | | | 3200 |
| 34 | | 500 | |
| 36 | | | |
| 40 | | | |

**Table 10: Working time, initial curing time and minimum curing time**

| Temperature in the base material [℃] | Maximum working time $t_{work}$ [min] | Initial curing time $t_{cure,ini}$ [h] | Minimum curing time $t_{cure}$ [h] |
|---|---|---|---|
| 5 to 9 | 120 | 18 | 72 |
| 10 to 14 | 90 | 12 | 48 |
| 15 to 19 | 30 | 8 | 24 |
| 20 to 24 | 25 | 6 | 12 |
| 25 to 29 | 20 | 5 | 10 |
| 30 to 39 | 12 | 4 | 8 |
| 40 | 12 | 2 | 4 |



| | |
|---|---|
| **Injection system Hilti HIT RE 500-SD for rebar connection** | **Annex 18** |
| **Maximum embedment depth per dispenser Working time and curing times** | |

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## Values for pre-calculation of lap splice length with Hilti HIT-RE 500-SD

Example for C20/25, good bond conditions, Rebar yield strength 500 N/mm², for all drilling procedures, excluding diamond wet (DD)

| Rebar Ø [mm] | $\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=1,0$ | | | $\alpha_2$ or $\alpha_5$= 0,7 $\alpha_1 = \alpha_3 = \alpha_4 = 1,0$ | | |
|---|---|---|---|---|---|---|
| | Anchorage length $l_{bd}$ [mm] | Design value $N_{Rd}$ [kN] | Mortar volume [ml] | Anchorage length $l_{bd}$ [mm] | Design value $N_{Rd}$ [kN] | Mortar volume [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** |

* Values corresponding to the minimum anchorage length.
** Values corresponding to the minimum drill bit size.
The design value is valid for "good bond conditions" as described in EN 1992-1-1. For all other conditions multiply by the value by 0.7.
The volume of mortar correspond to the formula "$1,2*(d_0^2-d_S^2)*\pi*lb/4$"

**Injection system Hilti HIT RE 500-SD for rebar connection**

**Pre-calculated values for the anchorage length**
**Example for rebar ($f_{y,k}$ = 500 N/mm²) in C20/25**

**Annex 19**

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## Values for pre-calculation of anchoring with Hilti HIT-RE 500-SD

Example for C20/25, good bond conditions, Rebar yield strength 500 N/mm²,
For all drilling procedures, excluding diamond wet (DD)

| Rebar Ø | $\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=1,0$ | | | $\alpha_2$ or $\alpha_5$= 0,7<br>$\alpha_1 = \alpha_3 = \alpha_4 = 1,0$ | | |
|---|---|---|---|---|---|---|
| | Anchorage length $l_{bd}$ | Design value $N_{Rd}$ | Mortar volume | Anchorage length $l_{bd}$ | Design value $N_{Rd}$ | Mortar volume |
| [mm] | [mm] | [kN] | [ml] | [mm] | [kN] | [ml] |
| 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** |
| 26 | 369* | 69,33 | 191 | 369* | 99,05 | 191 |
| | 520 | 97,70 | 269 | 520 | 139,58 | 269 |
| | 780 | 146,56 | 404 | 780 | 209,37 | 404 |
| | 1040 | 195,41 | 538 | - | - | - |
| | **1229** | **230,92** | **636** | **860** | **230,84** | **445** |
| 28 | 397 | 80,35 | 165 | 397 | 114,78 | 165 |
| | 600 | 121,44 | 249 | 600 | 173,49 | 249 |
| | 840 | 170,02 | 349 | 840 | 242,88 | 349 |
| | 1120 | 226,69 | 466 | - | - | - |
| | **1323** | **267,78** | **550** | **926** | **267,75** | **385** |
| 30 | 425 | 92,22 | 188 | 425 | 131,74 | 188 |
| | 600 | 130,09 | 265 | 600 | 185,84 | 265 |
| | 900 | 195,13 | 398 | 900 | 278,76 | 398 |
| | 1200 | 260,18 | 530 | - | - | - |
| | **1418** | **307,44** | **627** | **992** | **307,26** | **438** |
| 32 | 454 | 104,87 | 246 | 454 | 149,81 | 246 |
| | 640 | 147,94 | 347 | 640 | 211,34 | 347 |
| | 960 | 221,90 | 521 | 960 | 317,01 | 521 |
| | 1280 | 295,87 | 695 | - | - | - |
| | **1512** | **349,50** | **821** | **1059** | **349,70** | **575** |
| 34 | 482* | 118,43 | 395 | 482* | 169,19 | 395 |
| | 680 | 167,07 | 557 | 680 | 238,67 | 557 |
| | 1020 | 250,61 | 835 | 1020 | 358,01 | 835 |
| | 1360 | 334,14 | 1114 | - | - | - |
| | **1607** | **394,83** | **1316** | **1125** | **394,87** | **921** |
| 36 | 534* | 132,78 | 367 | 534* | 189,69 | 367 |
| | 720 | 179,17 | 495 | 720 | 255,95 | 495 |
| | 1080 | 268,75 | 742 | 1080 | 383,93 | 742 |
| | 1440 | 358,34 | 989 | - | - | - |
| | **1779** | **442,61** | **1222** | **1191** | **423,39** | **818** |
| 40 | 621* | 163,96 | 834 | 621* | 234,22 | 834 |
| | 800 | 211,18 | 1074 | 800 | 301,68 | 1074 |
| | 1200 | 316,76 | 1612 | 1200 | 452,52 | 1612 |
| | 1600 | 422,35 | 2149 | - | - | - |
| | **2070** | **546,52** | **2781** | **1323** | **498,90** | **1777** |

* Values corresponding to the minimum anchorage length.
The design value is valid for "good bond conditions" as described in EN 1992-1-1. For all other conditions multiply by the value by 0.7.
The volume of mortar correspond to the formula "$1,2*(d_0^2-d_S^2)*\pi*l_b/4$"



**Injection system Hilti HIT RE 500-SD for rebar connection**

**Pre-calculated values for the anchorage length**
**Example for rebar ($f_{y,k}$ = 500 N/mm²) in C20/25**

**Annex 20**

Deutsches Institut für Bautechnik DIBt

## Values for pre-calculation of overlap joints with Hilti HIT-RE 500-SD

Example for C20/25, good bond conditions, Rebar yield strength 500 N/mm²,
For all drilling procedures, excluding diamond wet (DD)

| Rebar Ø | $\alpha_1=\alpha_2=\alpha_3=\alpha_5=\alpha_6=1,0$ | | | $\alpha_2$ or $\alpha_5$= 0,7<br>$\alpha_1 = \alpha_3 = \alpha_6 = 1,0$ | | |
|---|---|---|---|---|---|---|
| | Lap length $l_0$ | Design value $N_{Rd}$ | Mortar volume | Lap length $l_0$ | Design value $N_{Rd}$ | Mortar volume |
| [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** | **21,90** | **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** | **34,16** | **43** | **331** | **34,15** | **30** |
| 12 | 200* | 17,33 | 21 (10)** | 200* | 24,75 | 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** | **49,12** | **60** | **397** | **49,13** | **42** |
| 14 | 210* | 21,25 | 25 | 210* | 30,36 | 25 |
| | 280 | 28,34 | 34 | 280 | 40,48 | 34 |
| | 420 | 42,50 | 51 | 420 | 60,72 | 51 |
| | 560 | 56,67 | 68 | - | - | - |
| | **662** | **66,99** | **80** | **463** | **66,94** | **56** |
| 16 | 240* | 27,74 | 33 | 240* | 39,63 | 33 |
| | 320 | 36,98 | 43 | 320 | 52,83 | 43 |
| | 480 | 55,48 | 65 | 480 | 79,25 | 65 |
| | 640 | 73,97 | 87 | - | - | - |
| | **756** | **87,37** | **103** | **529** | **87,34** | **72** |
| 18 | 270* | 35,05 | 41 | 270* | 50,07 | 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* | 43,33 | 64 | 300* | 61,90 | 64 |
| | 400 | 57,78 | 85 | 400 | 82,54 | 85 |
| | 600 | 86,66 | 127 | 600 | 123,81 | 127 |
| | 800 | 115,55 | 170 | - | - | - |
| | **945** | **136,50** | **200** | **662** | **136,60** | **140** |
| 22 | 330* | 52,44 | 93 | 330* | 74,91 | 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* | 62,38 | 152 | 360* | 89,11 | 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** |

* Values corresponding to the minimum anchorage length.
** Values corresponding to the minimum drill bit size.
The design value is valid for "good bond conditions" as described in EN 1992-1-1. For all other conditions multiply by the value by 0.7.
The volume of mortar correspond to the formula "$1,2*(d_0^2-d_S^2)*\pi*lb/4$"



**Injection system Hilti HIT RE 500-SD for rebar connection**

**Pre-calculated values for the lap length**
**Example for rebar ($f_{y,k}$ = 500 N/mm²) in C20/25**

**Annex 21**

Deutsches Institut für Bautechnik DIBt

## Values for pre-calculation of overlap joints with Hilti HIT-RE 500-SD

Example for C20/25, good bond conditions, Rebar yield strength 500 N/mm²,
For all drilling procedures, excluding diamond wet (DD)

| Rebar Ø | $\alpha_1=\alpha_2=\alpha_3=\alpha_5=\alpha_6=1,0$ | | | $\alpha_2$ or $\alpha_5$= 0,7<br>$\alpha_1 = \alpha_3 = \alpha_6 = 1,0$ | | |
|---|---|---|---|---|---|---|
| | Lap length $l_0$ | Design value $N_{Rd}$ | Mortar volume | Lap length $l_0$ | Design value $N_{Rd}$ | Mortar volume |
| [mm] | [mm] | [kN] | [ml] | [mm] | [kN] | [ml] |
| 25 | 375* | 67,76 | 141 | 375* | 96,80 | 141 |
| | 500 | 90,34 | 188 | 500 | 129,06 | 188 |
| | 750 | 135,52 | 282 | 750 | 193,59 | 282 |
| | 1000 | 180,69 | 376 | - | - | - |
| | **1181** | **213,39** | **444** | **827** | **213,47** | **311** |
| 26 | 390* | 73,28 | 202 | 390* | 104,68 | 202 |
| | 520 | 97,70 | 269 | 520 | 139,58 | 269 |
| | 780 | 146,56 | 404 | 780 | 209,37 | 404 |
| | 1040 | 195,41 | 538 | - | - | - |
| | **1229** | **230,92** | **636** | **860** | **230,84** | **445** |
| 28 | 420* | 85,01 | 175 | 420* | 121,44 | 175 |
| | 600 | 121,44 | 249 | 600 | 173,49 | 249 |
| | 840 | 170,02 | 349 | 840 | 242,88 | 349 |
| | 1120 | 226,69 | 466 | - | - | - |
| | **1323** | **267,78** | **550** | **926** | **267,75** | **385** |
| 30 | 450* | 97,57 | 199 | 450* | 139,38 | 199 |
| | 600 | 130,09 | 265 | 600 | 185,84 | 265 |
| | 900 | 195,13 | 398 | 900 | 278,76 | 398 |
| | 1200 | 260,18 | 530 | - | - | - |
| | **1418** | **307,44** | **627** | **992** | **307,26** | **438** |
| 32 | 480* | 110,95 | 261 | 480* | 158,50 | 261 |
| | 640 | 147,94 | 347 | 640 | 211,34 | 347 |
| | 960 | 221,90 | 521 | 960 | 317,01 | 521 |
| | 1280 | 295,87 | 695 | - | - | - |
| | **1512** | **349,50** | **821** | **1059** | **349,70** | **575** |
| 34 | 510* | 125,30 | 418 | 510* | 179,01 | 418 |
| | 680 | 167,07 | 557 | 680 | 238,67 | 557 |
| | 1020 | 250,61 | 835 | 1020 | 358,01 | 835 |
| | 1360 | 334,14 | 1114 | - | - | - |
| | **1607** | **394,83** | **1316** | **1125** | **394,87** | **921** |
| 36 | 540* | 134,38 | 371 | 540* | 191,97 | 371 |
| | 720 | 179,17 | 495 | 720 | 255,95 | 495 |
| | 1080 | 268,75 | 742 | 1080 | 383,93 | 742 |
| | 1440 | 358,34 | 989 | - | - | - |
| | **1779** | **442,61** | **1222** | **1191** | **423,39** | **818** |
| 40 | 621* | 163,93 | 834 | 621* | 234,18 | 834 |
| | 800 | 211,18 | 1074 | 800 | 301,68 | 1074 |
| | 1200 | 316,76 | 1612 | 1200 | 452,52 | 1612 |
| | 1600 | 422,35 | 2149 | - | - | - |
| | **2070** | **546,52** | **2781** | **1323** | **498,90** | **1777** |

* Values corresponding to the minimum anchorage length.
The design value is valid for "good bond conditions" as described in EN 1992-1-1. For all other conditions multiply by the value by 0.7.
The volume of mortar correspond to the formula "$1,2*(d_0^2-d_S^2)*\pi*l_b/4$"



**Injection system Hilti HIT RE 500-SD for rebar connection**

**Pre-calculated values for the lap length**
**Example for rebar ($f_{y,k}$ = 500 N/mm²) in C20/25**

**Annex 22**