

European Technical Approval ETA-12/0083

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung <i>Trade name</i>	Injektionssystem Hilti HIT-HY 200-R für Bewehrungsanschlüsse <i>Injection System Hilti HIT-HY 200-R for rebar connection</i>
Zulassungsinhaber <i>Holder of approval</i>	Hilti Aktiengesellschaft Business Unit Anchors 9494 Schaan FÜRSTENTUM LIECHTENSTEIN
Zulassungsgegenstand und Verwendungszweck <i>Generic type and use of construction product</i>	Nachträglich eingemörtelter Bewehrungsanschluss mit Hilti Injektionsmörtel HIT-HY 200-R <i>Post-installed rebar connection with Hilti injection mortar HIT-HY 200-R</i>
Geltungsdauer: <i>Validity:</i>	vom <i>from</i> bis <i>to</i>
Herstellwerk <i>Manufacturing plant</i>	Hilti Werke

Diese Zulassung umfasst
This Approval contains

31 Seiten einschließlich 21 Anhänge
31 pages including 21 annexes

I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
 - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - *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 1998⁴, as amended by law of 31 October 2006⁵;*
 - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁶;
 - 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.
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- 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 2006*, p. 2407, 2416
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 the product and 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 injection mortar HIT-HY 200-R in accordance with the regulations for reinforced concrete construction.

Reinforcing bars made of steel with a diameter d_s from 8 to 32 mm according to Annex 4 or the Hilti tension anchor HZA-R or HZA-HCR sizes 12, 16 and 20 according to Annex 6 and Hilti injection mortar HIT-HY 200-R are used for 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 tension anchor HZA-R or HZA-HCR 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 or compressed air drilling. 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 tension anchor HZA-R or HZA-HCR 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, Figure 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 tension anchor HZA-HCR made of high corrosion resistant steel 1.4529 may be used in structures subject to dry internal conditions and also in structures subject to external atmospheric exposure, in permanently damp internal conditions or in other particular aggressive conditions. Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

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 documentation⁷ of this European technical approval.

The two components of the injection mortar Hilti HIT-HY 200-R are delivered in unmixed condition in foil packs of sizes 330 ml or 500 ml according to Annex 1. Each foil pack is marked with the identifying mark "HY 200-R", with the batch number and expiry date.

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

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.

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

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the Decision 96/582/EC of the European Commission⁹ system 2(i) (referred to as System 1) of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

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

- (a) Tasks for the manufacturer:
 - (1) factory production control;
 - (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed 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.

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.

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.

3.2.1.2 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of anchors in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

3.2.2 Tasks for the approved bodies

The approved body shall perform the

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

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

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

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

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

3.3 CE marking

The CE marking shall be affixed on each packaging of the 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 ℓ_v and length for markings ℓ_m on the injection extension according to Annex 16,
- Use of a drill aid for anchorages close to the edge (see Annex 10),
- 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.

Tension anchor HZA-R or HZA-HCR according to Annex 6 shall be designed for the welded-on reinforcement steel B500B. The length of the bonded-in 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 tension anchor HZA-R or HZA-HCR shall be greater than the minimum of $5 d_s$ and 50 mm (see Annex 5 and 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

σ_{sd} = calculated design stress of the rebar

f_{bd} = design value of bond strength according to Annex 8, Table 5

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 ℓ_{bd} shall be determined in accordance with EN 1992-1-1, Section 8.4.4:

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

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

α_1 = 1.0 for straight bars

α_2 = 0.7...1.0 calculated acc. to EN 1992-1-1, Table 8.2

α_3 = 1.0 because of no transverse reinforcement

α_4 = 1.0 because of no welded transverse reinforcement

$\alpha_5 = 0.7 \dots 1.0$ 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 $\ell_{b,rqd}$; 10d_s; 100 mm} under tension

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

The maximum permissible anchorage depth is given in Annex 8 in relation to the dispenser to be used.

4.3.4 Overlap joints

The required design lap length ℓ_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

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

$\alpha_3 = 1.0$ because of no transverse reinforcement

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

$\alpha_6 = 1.0 \dots 1.5$ 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 $\alpha_6 \ell_{b,rqd}$; 15d_s; 200 mm}

The maximum permissible anchorage depth is given in Annex 8 in relation to the dispenser and the bar diameter 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: ℓ_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 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 tension anchor HZA-R or HZA-HCR:

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: ℓ_0 = required lap length acc. to Section 4.3.4 and to EN 1992-1-1

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

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 tension anchor HZA-R or HZA-HCR 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 tension anchor HZA-R or HZA-HCR 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 tension anchor HZA-R or HZA-HCR is installed as follows:

- the installation of post-installed rebar respectively tension anchor HZA-R or HZA-HCR 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 9 to 17), 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 -10 °C and no more than $+40$ °C; observing the curing time given in Annex 17.

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 and 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 pack 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.

Georg Feistel
Head of Department

beglaubigt:
G. Lange

Product description and intended use

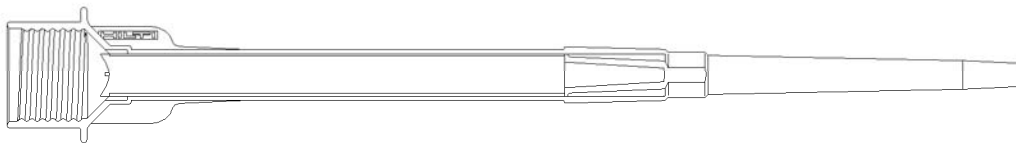
The post-installed rebar connection consists of injection mortar Hilti HIT-HY 200-R and an embedded straight deformed reinforcing bar with properties of class B and C according to Annex C of EN 1992-1-1 or the Hilti tension anchor HZA-R (HZA-HCR).

Foil pack 330ml and 500ml

Marking
HY 200-R
Batch number
Expiry date



Static mixer Hilti HIT-RE-M:



Reinforcing bar (see Annex 4):



Hilti Tension anchor HZA-R (HZA-HCR) (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 EN 1992-1-1.

Installation in dry or wet concrete, it must not 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 200-R for rebar connection

Annex 1

Product description and intended use

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

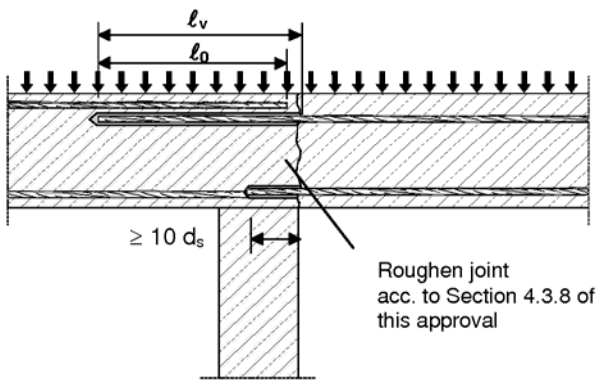


Figure 2: Overlap joint at a foundation of a column or wall where the rebars are stressed in tension

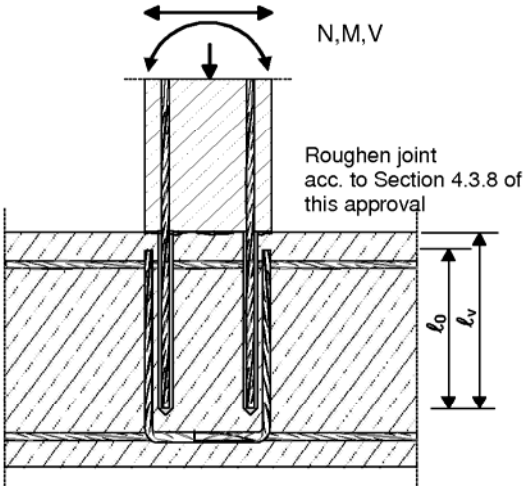


Figure 3: End anchoring of slabs or beams, designed as simply supported

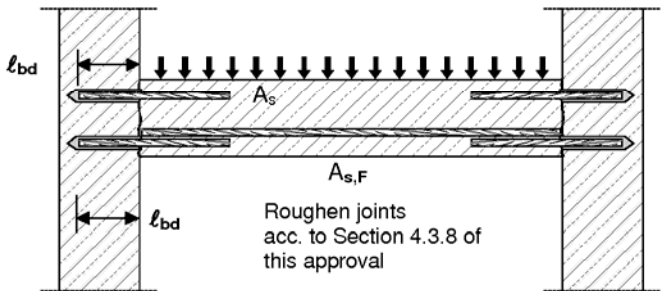


Figure 4: Rebar connection for components stressed primarily in compression. The rebars are stressed in compression.

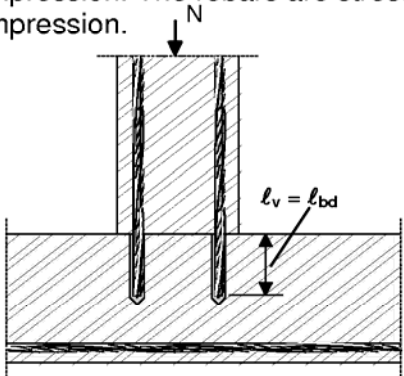
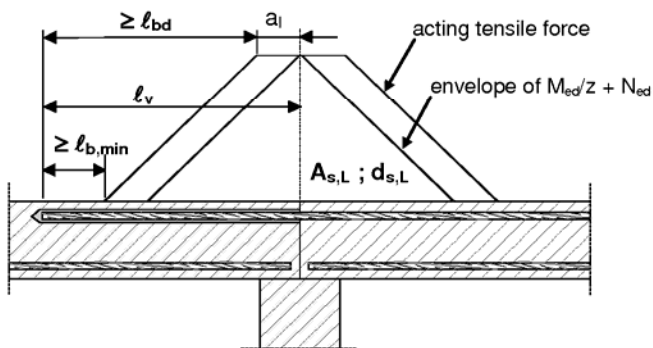


Figure 5: Anchoring of reinforcement to cover the line of acting tensile force



Note to Figure 1 to 5:

In the Figures no transverse reinforcement is plotted, the transverse reinforcement as required by 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.

Injection system Hilti HIT-HY 200-R for rebar connection	Annex 2
Examples of use for rebars	

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

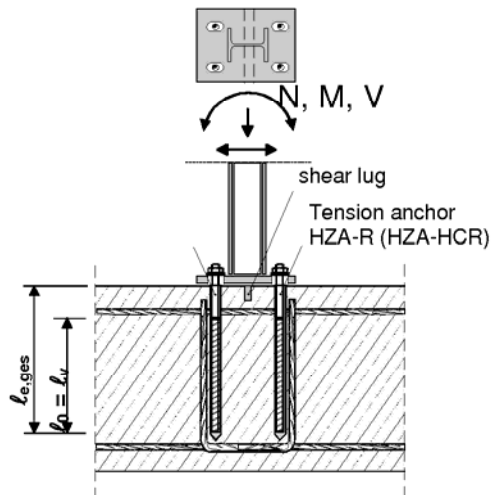


Figure 7: Overlap joint for the anchorage of barrier posts

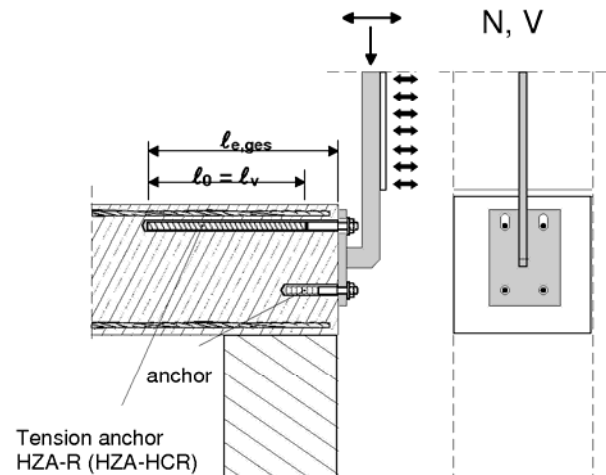
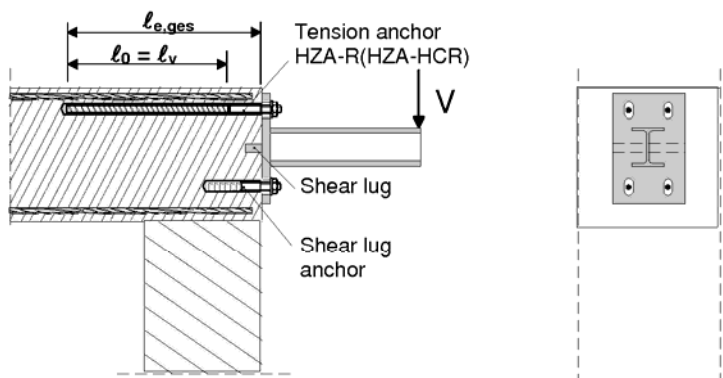


Figure 8: Overlap joint for the anchorage of cantilever members



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 (HZA-HCR).

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-HY 200-R for rebar connection

Annex 3

Examples of use
for tension anchor HZA-R (HZA-HCR)

Figure 9: Properties of reinforcing bars “rebars”



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

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

Rip height h:

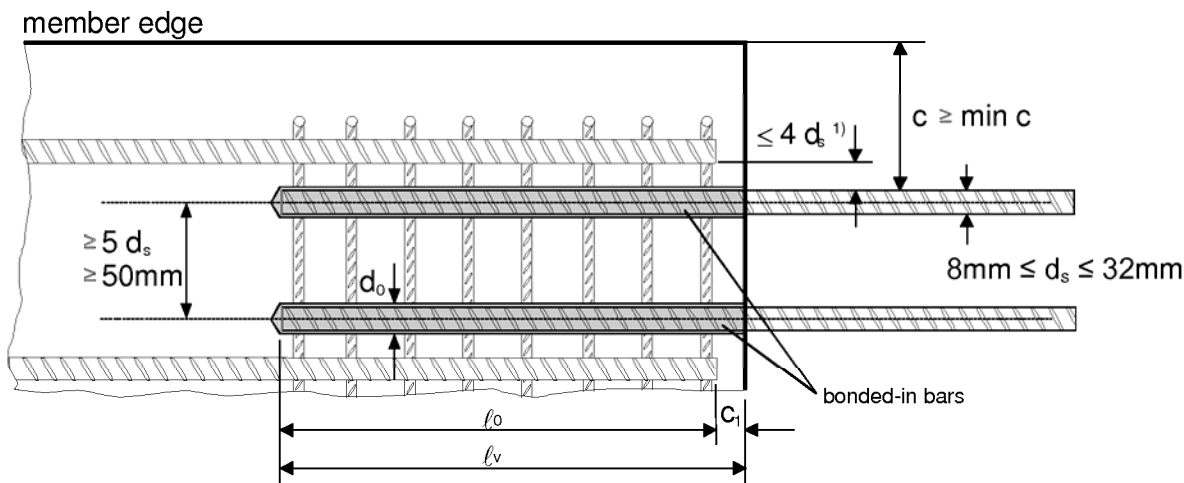
The maximum outer rebar diameter over the ribs shall be:
nominal diameter of the bar: $d + 2 \cdot h$ ($h \leq 0,07 \cdot d$)

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 4

Description of rebars

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 resp. l_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
 l_0 lap length
 l_v effective embedment depth
 d_0 nominal drill bit diameter, see Annex 10

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 5

Rebars
Spacing and edge distances
General design rules

Figure 11: Tension anchor HZA-R (HZA-HCR)

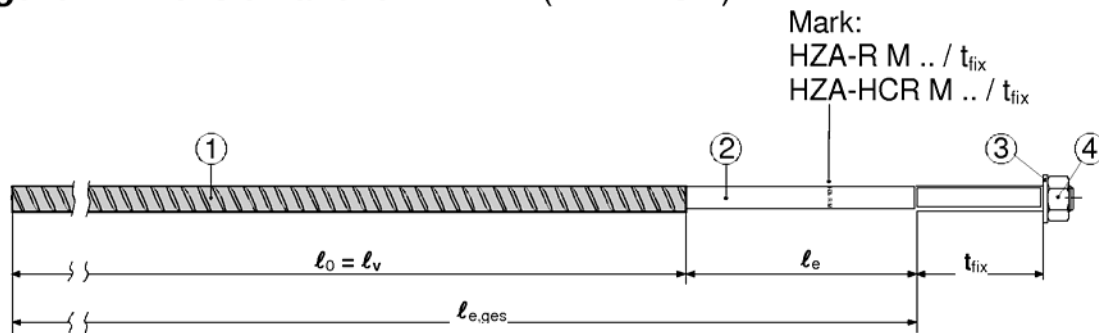


Table 1: Tension anchor HZA-R (HZA-HCR) materials

Part	Designation	Material	
		HZA-R	HZA-HCR
1	B500-B	not galvanised reinforcement steel acc. DIN 488	
2	Round steel smooth with thread	Stainless steel 1.4404, 1.4571 EN 10088	High corrosion resistant steel 1.4529 EN 10088
3	Washer		
4	Hex nut	Stainless steel 1.4401, 1.4571 EN 10088 Strength class 80 EN ISO 3506	High corrosion resistant steel 1.4529 EN 10088 Strength class 80 EN ISO 3506

Table 2: Tension anchor HZA-R (HZA-HCR) dimensions

HZA-R (HZA-HCR)	M12 / t_{fix}	M16 / t_{fix}	M20 / t_{fix}
Thread diameter [mm]	12	16	20
Width across nut flats SW [mm]	19	24	30
Effective embedment depth $\ell_v \leq 1)$ [mm]	800	900	900
Length of smooth shaft $\ell_e \geq$ [mm]	100	100	100
Max torque moment T_{max} [Nm]	60	100	150
Minimum thickness of fixture t_{fix} [mm]	5	5	5
Maximum thickness of fixture t_{fix} [mm]	400	400	400

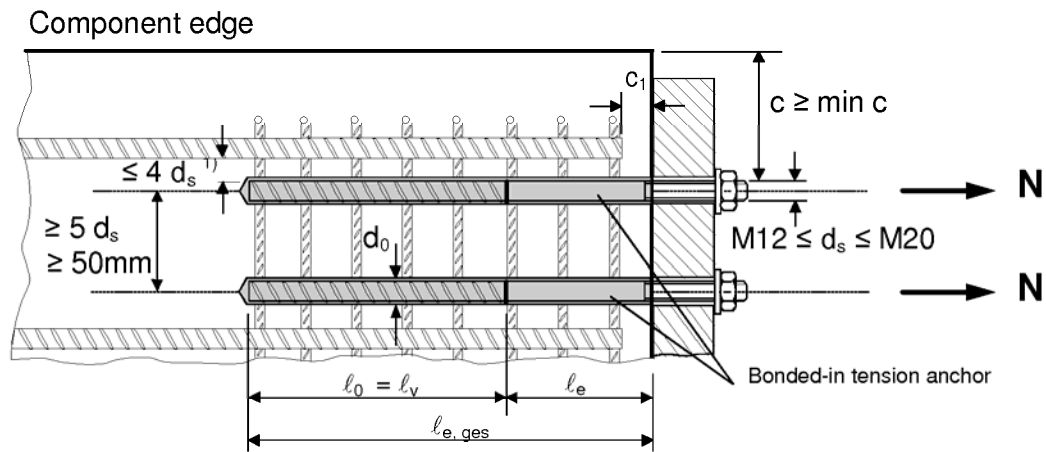
¹⁾ may be shortened according to static calculation

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 6

Hilti tension anchor HZA-R (HZA-HCR)
Dimensions and materials

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



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 $4d_s$.

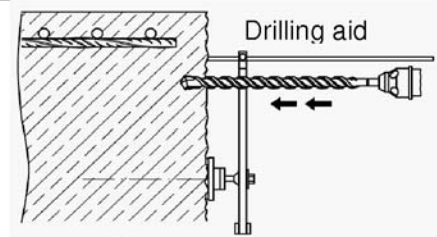
The following applies to Figure 12:

- With the tension anchor HZA-R (HZA-HCR), only tensile forces in the direction of the bar axis may be transmitted.
- ℓ_v resp. ℓ_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
 ℓ_0 lap length
 ℓ_v effective embedment depth
 ℓ_e length of the smooth shaft; $\ell_e \geq 100 \text{ mm}$
 $\ell_{e, ges}$ total embedment depth
 d_0 nominal drill bit diameter, see Annex 10

Injection system Hilti HIT-HY 200-R for rebar connection	Annex 7
Hilti tension anchor HZA-R (HZA-HCR)	
Spacing and edge distances General design rules	

Table 3: Minimum concrete cover $\min c^1$ of the bonded-in rebar or tension anchor HZA-R (HZA-HCR) depending on drilling method and drilling tolerance



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

¹⁾ see Annexes 5 and 7, Figures 10 and 12

Comments: The minimum concrete cover acc. EN 1992-1-1 must be observed

Table 4: Minimum anchorage lengths and lap lengths for C20/25 according to EN 1992-1-1: $\ell_{b,min}$ (8.6) and $\ell_{l,min}$ (8.11) for good bond conditions and $\alpha_s = 1,0$ with maximum yield stress $\sigma_{sd} = 435\text{N/mm}^2$ for rebar B500-B and $\gamma_M = 1,15$ and maximum installation length

Rebar		Drilling method HD, CA		Concrete $> -10^\circ\text{C}$	Concrete $> 0^\circ\text{C}$
$\varnothing d_s$	$f_{y,k} [\text{N/mm}^2]$	$\ell_{b,min} [\text{mm}]$	$\ell_{l,min} [\text{mm}]$	$\ell_{max} [\text{mm}]$	$\ell_{max} [\text{mm}]$
8 mm	500	113	200	700	1000
10 mm	500	142	200	700	1000
12 mm	500	170	200	700	1000
14 mm	500	198	210	700	1000
16 mm	500	227	240	700	1000
18 mm	500	255	270	700	1000
20 mm	500	284	300	700	1000
22 mm	500	312	330	700	1000
24 mm	500	340	360	700	1000
25 mm	500	354	375	700	1000
26 mm	500	369	390	700	1000
28 mm	500	397	420	700	1000
30 mm	500	425	450	700	1000
32 mm	500	454	480	700	1000

Table 5: Design values of the bond resistance f_{bd} in N/mm^2 Hammer drilling, Compressed air drilling according to EN 1992-1-1 for good bond conditions (for all other bond conditions multiply the values by 0.7)

Rebar- \varnothing	Concrete class								
d_s	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
8 to 32 mm	1,6	2,0	2,3	2,7	3,0	3,4	3,7	4,0	4,3

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 8

Minimum concrete cover \min
Minimum anchorage length and minimum lap length
Design values of ultimate bond resistance f_{bd}

Safety Regulations:



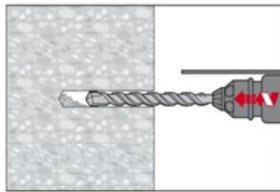
Review the Material Safety Data Sheet (MSDS) before use for proper and safe handling!

Wear well-fitting protective goggles, protective gloves and suitable protective clothing when working with Hilti HIT-HY 200-R.

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)

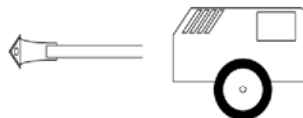


Drill hole to the required embedment depth using a hammer-drill with carbide drill bit set in rotation hammer mode, a Hilti hollow drill bit or a compressed air drill.

Hammer drill (HD)



Compressed air drill (CA)



Rebar-Ø d_s	HZA-R HZA-HCR	Drill bit diameters d_0 [mm]	
		Hammer drill (HD)	Comp. air drill (CA)
8 mm		12 (10)*	-
10 mm		14 (12)*	-
12 mm	M12	16 (14)*	17
14 mm		18	17
16 mm	M16	20	20
18 mm		22	22
20 mm	M20	25	26
22 mm		28	28
24 mm		32	32
25 mm		32	32
26 mm		35	35
28 mm		35	35
30 mm		37	35
32 mm		40	40

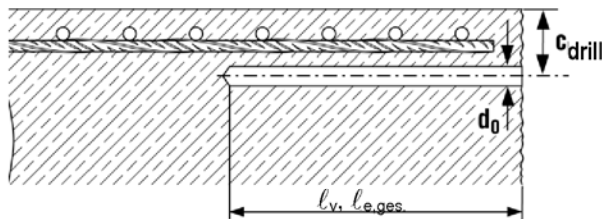
* max installation length $l = 250$ mm

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 9

Installation instruction I
Drill hole

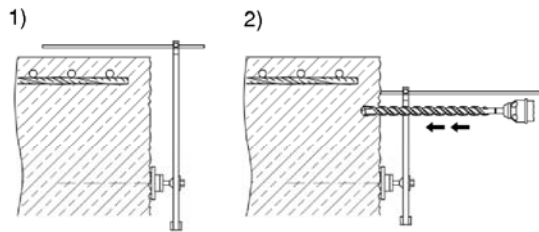
Splicing applications:



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

Drilling aid

Example: HIT-BH



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

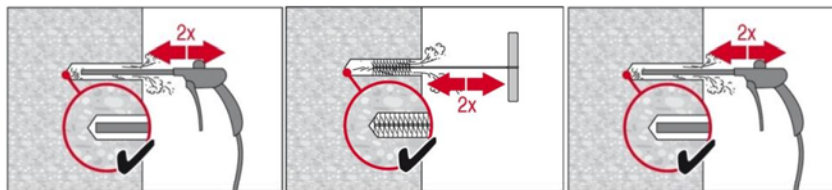
- A) Hilti drilling aid HIT-BH
- B) Slat or spirit level
- C) Visual check

2. Clean hole

The borehole must be free of dust, debris, water, ice, oil, grease and other contaminants prior to mortar injection.

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 $\varnothing \geq$ borehole \varnothing) 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.

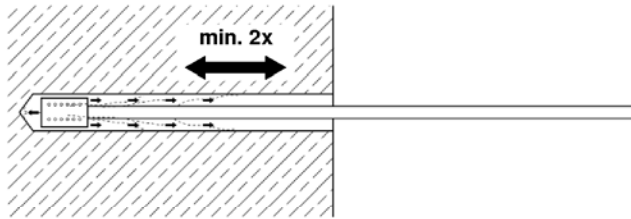
If required use additional accessories and extensions for air nozzle and brush to reach back of hole.

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 10

Installation instruction II
Clean bore hole

Deep Boreholes – Blowing



For boreholes deeper than 250mm (for $d_s=8\text{mm}-12\text{mm}$) resp. deeper than $20 \times d_s$ (for $d_s > 12\text{mm}$) use the appropriate air nozzle Hilti HIT-DL (see table below).

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

Rebar-Ø	HZA-R HZA-HCR	Drill bit and Core bit diameters d_0 [mm]		Air Nozzle Hilti HIT-DL	Extension
d_s		Hammer-drill HD	Comp. air drill CA		
8 mm		12 (10)*	-	HIT-DL 12 (10)*	HIT-DL 10/0,8 or HIT-DL V10/1
10 mm		14 (12)*	-	HIT-DL 14 (12)*	
12 mm	M12	16 (14)*	17	HIT-DL 16 (14)*	
14 mm		18	17	HIT-DL 18	
16 mm	M16	20	20	HIT-DL 20	HIT-DL 16/0,8 or HIT-DL B and/or HIT-VL 16/0,7 and/or HIT-VL 16
18 mm		22	22	HIT-DL 20	
20 mm	M20	25	26	HIT-DL 25	
22 mm		28	28	HIT-DL 25	
24 mm		32	32	HIT-DL 32	
25 mm		32	32	HIT-DL 32	
26 mm		35	35	HIT-DL 32	
28 mm		35	35	HIT-DL 32	
30 mm		37	35	HIT-DL 32	
32 mm		40	40	HIT-DL 32	

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

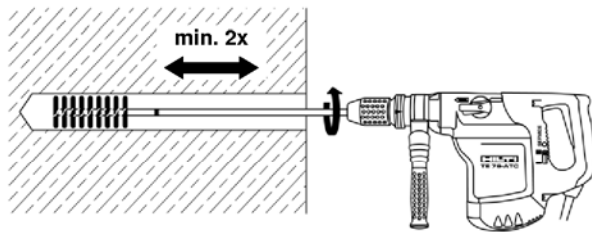
* max installation length $l = 250$ mm

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 11

Installation instruction III
Blow out bore hole

Deep boreholes – brushing



For boreholes deeper than 250mm (for $d_s=8\text{mm}-12\text{mm}$) resp. deeper than $20 \times d_s$ (for $d_s > 12\text{mm}$) use machine brushing and brush extensions HIT-RBS.

Safety Tips:

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

Rebar-Ø	HZA-R HZA-HCR	Drill bit and Core bit diameters d_0 [mm] / steel brush			
d_s		Hammer drill HD		Comp. air drill CA	
		d_0	HIT-RB	d_0	HIT-RB
8 mm		12 (10)*	HIT-RB 12 (10)*	-	-
10 mm		14 (12)*	HIT-RB 14 (12)*	-	-
12 mm	M 12	16 (14)*	HIT-RB 16 (14)*	17	HIT-RB 18
14 mm		18	HIT-RB 18	17	HIT-RB 18
16 mm	M 16	20	HIT-RB 20	20	HIT-RB 22
18 mm		22	HIT-RB 22	22	HIT-RB 22
20 mm	M 20	25	HIT-RB 25	26	HIT-RB 28
22 mm		28	HIT-RB 28	28	HIT-RB 28
24 mm		32	HIT-RB 32	32	HIT-RB 32
25 mm		32	HIT-RB 32	32	HIT-RB 32
26 mm		35	HIT-RB 35	35	HIT-RB 35
28 mm		35	HIT-RB 35	35	HIT-RB 35
30 mm		37	HIT-RB 37	35	HIT-RB 35
32 mm		40	HIT-RB 40	40	HIT-RB 40

* max installation length $l = 250 \text{ mm}$

Machine brushing: 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.

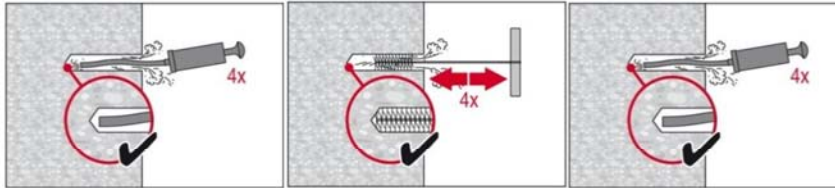
The diameter of the round steel brush shall be checked before use. The minimum brush diameter has to be at least equal to the borehole diameter d_0 . The round steel brush shall produce natural resistance as it enters the drill hole. If this is not the case, please use a new brush or a brush with a larger diameter.

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 12

Installation instruction IV
Brush bore hole

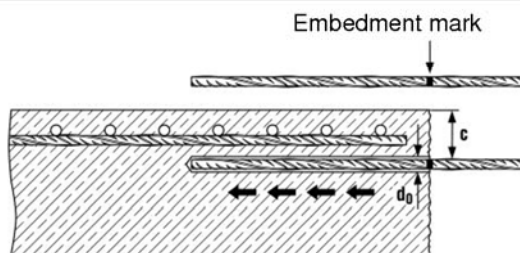
2.2 Manual cleaning: The borehole must be free of dust, debris, water, ice, oil, grease and other contaminants prior to mortar injection.



As an alternative to compressed air cleaning, a manual cleaning is permitted for hammer drilled boreholes up to hole diameters $d_0 \leq 20\text{mm}$ and depths l_v resp. $l_{e,ges.} \leq 160\text{mm}$ or $10 \cdot d$.

- **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 HIT-RB (brush diameter \geq 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.

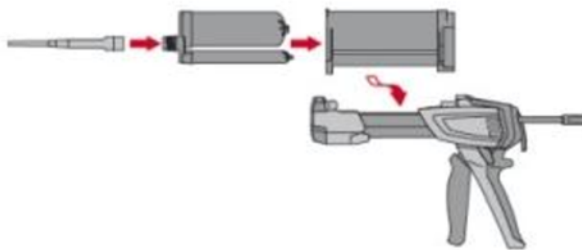
3. Rebar preparation and injection system preparation



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

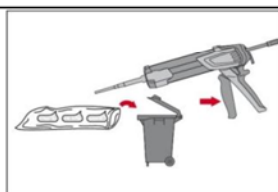
Mark the embedment depth on the rebar (e.g. with tape) $\rightarrow l_v$

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



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.



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

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.

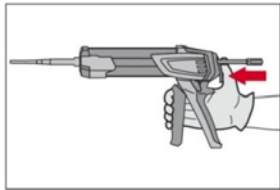
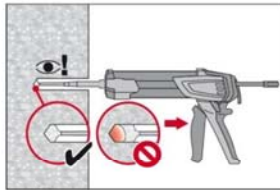
After changing a mixing nozzle, the first few trigger pulls must be discarded as described above. For each new foil pack a new mixing nozzle must be used.

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 13

Installation instruction V
Manual cleaning
Rebar preparation and injection system preparation

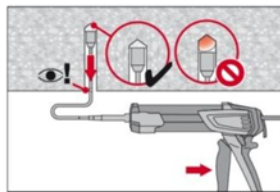
4. Inject mortar into borehole without forming air pockets.



- **Injection method for borehole depth ≤ 250 mm:**

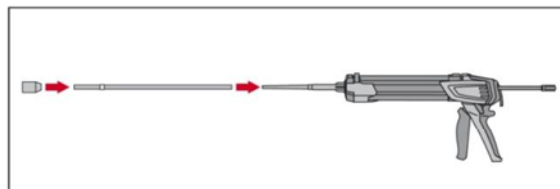
Inject the mortar from the back of the hole towards the front and slowly withdraw the mixing nozzle step by step after each trigger pull.

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.



- **Piston plug injection for borehole depth > 250 mm or overhead applications:** Assemble mixing nozzle, extension(s) and appropriately sized piston plug. 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.



HDM 330

Manual dispenser (330 ml)

HDM 500

Manual dispenser (330 / 500 ml)

HDE 500

Electric dispenser (330 / 500 ml)

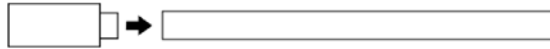
Injection system Hilti HIT-HY 200-R for rebar connection

Annex 14

Installation instruction VI
Mortar injection

Piston plug

Injection extension



Connect the selected piston plug with the appropriate injection extension.

HIT-SZ 12 – HIT-SZ 18 with HIT-VL 11/1.0

≥ HIT-SZ 20 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.

Rebar-Ø	HZA-R HZA-HCR	Drill bit and Core bit diameters d ₀ [mm] / piston plug			
d _s		Hammer drill HD		Comp. air drill CA	
		d ₀	HIT-SZ	d ₀	HIT-SZ
8 mm		12 (10)*	HIT-SZ 12 (-)*	-	-
10 mm		14 (12)*	HIT-SZ 14 (12)*	-	-
12 mm	M12	16 (14)*	HIT-SZ 16 (14)*	17	HIT-SZ 18
14 mm		18	HIT-SZ 18	17	HIT-SZ 18
16 mm	M16	20	HIT-SZ 20	20	HIT-SZ 22
18 mm		22	HIT-SZ 22	22	HIT-SZ 22
20 mm	M20	25	HIT-SZ 25	26	HIT-SZ 28
22 mm		28	HIT-SZ 28	28	HIT-SZ 28
24 mm		32	HIT-SZ 32	32	HIT-SZ 32
25 mm		32	HIT-SZ 32	32	HIT-SZ 32
26 mm		35	HIT-SZ 35	35	HIT-SZ 35
28 mm		35	HIT-SZ 35	35	HIT-SZ 35
30 mm		37	HIT-SZ 37	35	HIT-SZ 35
32 mm		40	HIT-SZ 40	40	HIT-SZ 40

* max installation length l = 250 mm

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 15

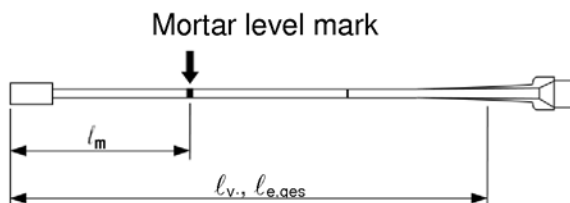
Installation instruction VII
Piston plug injection

Maximum permissible embedment depth corresponding to dispenser

Rebar-Ø	Dispenser	
d_s	HDM 330 HDM 500	HDE 500
8 mm to 32mm	70 cm	100 cm 70 cm ¹⁾

¹⁾ For concrete temperature < 0 °C

Remark: Injection of mortar at low temperatures is easier and faster when the mortar is heated up slowly to 20 °C. Especially for deep bore holes with use of extensions.
Injection of mortar at high temperatures gives longer working time when cooling down the mortar to 20 °C.

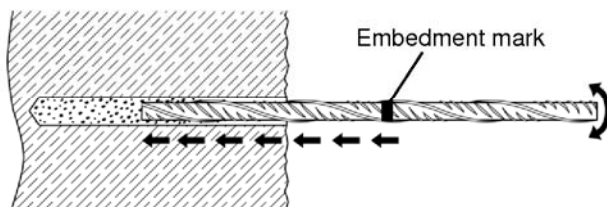


$$l_m = l_v \text{ resp. } l_{e,ges} \cdot \left(1,2 \cdot \frac{d_s^2}{d_0^2} - 0,2 \right) [\text{mm}]$$

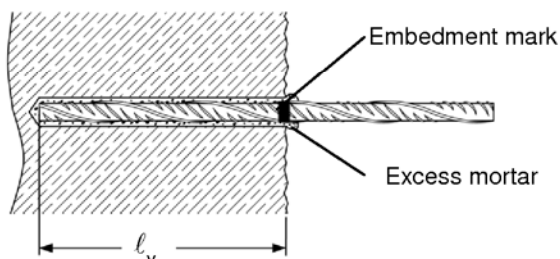
Mark the required mortar level l_m and embedment depth l_v resp. $l_{e,ges}$ with tape or marker on the injection extension.
Quick estimation: $l_m = 1/3 l_v$ resp. $l_m = 1/3 l_{e,ges}$
When using a piston plug HIT-SZ continue injection until the mortar level mark l_m becomes visible.

Precise formula for optimum mortar volume:

5. Insert rebar into borehole to the required embedment depth



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



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

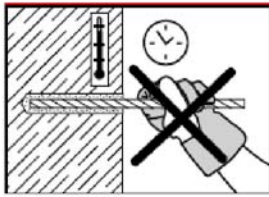
Proper installation

- Desired anchoring embedment is reached l_v : 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 200-R for rebar connection

Annex 16

Installation instruction VIII
Dispenser and embedment depth



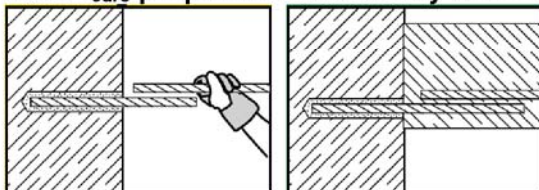
Observe the working time " t_{work} ", which varies according to temperature of base material. Minor adjustments to the rebar position may be performed during the working time. See table below.

Base material temperature	Hilti HIT-HY 200-R	
	working time " t_{work} ",	
-10 °C to -5 °C	3 hour	
-4 °C to 0 °C	2 hour	
1 °C to 5 °C	1 hour	
6 °C to 10 °C	40 min	
11 °C to 20 °C	15 min	
21 °C to 30 °C	9 min	
31 °C to 40 °C	6 min	

Maximum gel time " t_{work} "

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	Hilti HIT-HY 200-R	
	curing time " t_{cure} "	
-10 °C to -5 °C	20 hour	
-4 °C to 0 °C	7 hour	
1 °C to 5 °C	3 hour	
6 °C to 10 °C	2 hour	
11 °C to 20 °C	1 hour	
21 °C to 30 °C	1 hour	
31 °C to 40 °C	1 hour	

Curing time " t_{cure} "

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

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 17

Installation instruction X
Working time, curing time

Values for pre-calculation of anchoring with Hilti HIT-HY 200-R

Example for C20/25, good bond conditions, Rebar yield strength 500 N/mm²,
for all drilling procedures.

Rebar Ø	$\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=1,0$			$\alpha_2 \text{ or } \alpha_5 = 0,7$ $\alpha_1 = \alpha_3 = \alpha_4 = 1,0$		
	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]
8	113*	6,5	9 (4)**	113*	9,3	9 (4)**
	200	11,6	15 (7)**	160	13,2	12 (5)**
	290	16,8	22	210	17,3	16 (7)
	379	21,9	29	265	21,9	20
10	142*	10,3	13 (6)**	142*	14,7	13 (6)**
	250	18,1	23 (10)**	200	20,6	18 (8)**
	360	26,0	36	270	27,9	24
	472	34,1	43	330	34,1	30
12	170*	14,7	18 (8)**	170*	21,1	18 (8)**
	300	26,0	32	250	31,0	26 (12)**
	430	37,3	45	320	39,6	34
	567	49,2	60	397	49,2	42
14	199*	20,1	24	199*	28,8	24
	350	35,4	42	290	41,9	35
	510	51,6	62	380	54,9	46
	661	66,9	80	463	66,9	56
16	227*	26,2	31	227*	37,5	31
	400	46,2	54	330	54,5	45
	580	67,1	79	430	71,0	58
	756	87,4	103	529	87,4	72
18	255*	33,2	38	255*	47,4	38
	450	58,5	68	370	68,7	56
	650	84,5	98	480	89,2	72
	850	110,6	128	595	110,6	90
20	284*	41,0	60	284*	58,6	60
	500	72,3	106	410	84,6	87
	720	104,0	153	510	111,5	115
	945	136,6	200	662	136,7	140
22	312*	49,6	88	312*	70,9	88
	540	85,8	153	450	102,2	127
	770	122,4	218	590	134,0	167
	1000	159,0	283	728	165,3	206

* 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 " $1,2 \cdot (d_o^2 - d_s^2) \cdot \pi \cdot l_b / 4$ "

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 18

Pre-calculated values for the anchorage length
Example for rebar ($f_{y,k} = 500 \text{ N/mm}^2$) in C20/25 ($f_{bd} = 2,3 \text{ N/mm}^2$)

Values for pre-calculation of anchoring with Hilti HIT-HY 200-R

Example for C20/25, good bond conditions, Rebar yield strength 500 N/mm²,
for all drilling procedures

Rebar Ø	$\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=1,0$			$\alpha_2 \text{ or } \alpha_5 = 0,7$ $\alpha_1 = \alpha_3 = \alpha_4 = 1,0$		
	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]
24	340*	59,0	144	340*	84,2	144
	560	97,1	236	490	121,4	207
	780	135,3	329	640	158,6	270
	1000	173,4	422	794	196,7	335
25	355*	64,1	133	355*	91,6	133
	570	103,0	214	510	131,6	192
	790	142,7	297	670	172,9	252
	1000	180,6	376	827	213,4	311
26	369*	69,3	191	369*	99,0	191
	580	109,0	300	530	142,2	274
	790	148,4	409	700	187,9	362
	1000	187,9	517	860	230,8	445
28	397*	80,3	165	397*	114,7	165
	600	121,4	249	570	164,7	237
	800	161,9	333	750	216,8	312
	1000	202,3	416	926	267,6	385
30	426*	92,3	188	426*	131,9	188
	620	134,4	274	610	188,9	270
	810	175,6	358	800	247,7	354
	1000	216,8	442	992	307,2	438
32	454*	105,0	246	454	150,0	246
	640	148,0	347	640	211,4	347
	820	189,6	445	820	270,9	445
	1000	231,2	543	1000	330,3	543

* 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 " $1,2 \cdot (d_o^2 - d_s^2) \cdot \pi \cdot l_{bd} / 4$ "

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 19

Pre-calculated values for the anchorage length
Example for rebar ($f_{y,k} = 500 \text{ N/mm}^2$) in C20/25 ($f_{bd} = 2,3 \text{ N/mm}^2$)

Values for pre-calculation of lap splice lengths with Hilti HIT-HY 200-R
Example for C20/25, good bond conditions, Rebar yield strength 500 N/mm²,
for all drilling procedures.

Rebar Ø	$\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=1,0$			$\alpha_2 \text{ or } \alpha_5 = 0,7$ $\alpha_1 = \alpha_3 = \alpha_6 = 1,0$		
	Lap splice length l_0	Design value N_{Rd}	Mortar volume	Lap splice length l_0	Design value N_{Rd}	Mortar volume
[mm]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
8	200*	11,6	15 (7)**	200	16,5	15 (7)**
	260	15,0	20	220	18,2	17 (7)**
	320	18,5	24	240	19,8	18 (8)**
	379	21,9	29	265	21,9	20
10	200*	14,5	18 (8)**	200*	20,6	18 (8)**
	290	21,0	26	240	24,8	22 (10)**
	380	27,5	34	290	29,9	26
	472	34,1	43	330	34,1	30
12	200*	17,3	21 (10)**	200*	24,8	21 (10)**
	320	27,7	34	270	33,4	29
	440	38,2	46	330	40,9	35
	567	49,2	60	397	49,2	42
14	210*	21,2	25	210*	30,3	25
	360	36,4	43	340	41,9	35
	510	51,6	62	430	54,9	46
	661	66,9	80	529	66,9	56
16	240*	27,7	33	240*	39,6	33
	410	47,4	56	340	56,2	46
	580	67,1	79	430	71,0	58
	756	87,4	103	529	87,4	72
18	270*	35,1	41	270*	50,2	41
	460	59,8	69	380	70,6	57
	660	85,8	100	490	91,0	74
	850	110,6	128	595	110,6	90
20	300*	43,4	64	300*	61,9	64
	520	75,1	110	420	86,7	89
	730	105,5	155	540	111,5	115
	945	136,6	200	662	136,7	140
22	330*	52,5	124	330*	74,9	93
	550	87,4	156	460	104,5	130
	780	124,0	221	600	136,3	170
	1000	159,0	283	728	165,3	206

* 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 " $1,2 \cdot (d_0^2 - d_s^2) \cdot \pi \cdot l_b / 4$ "

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 20

Pre-calculated values for lap splice length
Example for rebar ($f_{y,k} = 500 \text{ N/mm}^2$) in C20/25 ($f_{bd} = 2,3 \text{ N/mm}^2$)

Values for pre-calculation of lap splice lengths with Hilti HIT-HY 200-R

Example for C20/25, good bond conditions, Rebar yield strength 500 N/mm²,
for all drilling procedures.

Rebar Ø	$\alpha_1=\alpha_2=\alpha_3=\alpha_4=\alpha_5=1,0$			$\alpha_2 \text{ or } \alpha_5 = 0,7$ $\alpha_1 = \alpha_3 = \alpha_6 = 1,0$		
	Lap splice length l_0	Design value N_{Rd}	Mortar volume	Lap splice length l_0	Design value N_{Rd}	Mortar volume
[mm]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
24	360*	62,4	152	360*	89,2	152
	570	98,8	241	500	123,9	211
	790	137,0	334	650	161,0	274
	1000	173,4	422	794	196,7	335
25	375*	67,7	124	375*	96,8	141
	580	104,8	218	530	136,8	199
	790	142,7	297	680	175,5	256
	1000	180,6	376	827	213,4	311
26	390*	73,3	124	390*	104,7	202
	590	110,8	305	550	147,6	285
	800	150,3	414	700	187,9	362
	1000	187,9	517	860	230,8	445
28	420*	85,0	124	420*	121,4	175
	610	123,4	278	590	170,5	245
	810	163,9	362	760	219,7	316
	1000	202,3	442	926	267,6	385
30	450*	97,5	124	450*	139,4	199
	630	136,6	278	630	195,1	278
	820	177,8	362	810	250,8	358
	1000	216,8	442	992	307,2	438
32	480*	111,0	124	480*	158,6	261
	650	150,3	353	650	214,7	353
	830	191,9	450	830	274,2	451
	1000	231,2	543	1000	330,3	543

* 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 " $1,2 \cdot (d_0^2 - d_s^2) \cdot \pi \cdot l_b / 4$ "

Injection system Hilti HIT-HY 200-R for rebar connection

Annex 21

Pre-calculated values for lap splice length
Example for rebar ($f_{y,k} = 500 \text{ N/mm}^2$) in C20/25 ($f_{bd} = 2,3 \text{ N/mm}^2$)