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

DIBt

Mitglied der EOTA
*Member of EOTA*

# European Technical Approval ETA-10/0060

English translation prepared by DIBt - Original version in German language

| | |
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| Handelsbezeichnung<br>*Trade name* | Tecfi Schwerlastanker HVE Rock<br>*Tecfi High Performance anchor HVE Rock* |
| Zulassungsinhaber<br>*Holder of approval* | Tecfi S.p.A<br>Strada Statale Appia, Km. 193<br>81050 PASTORANO (CE)<br>ITALIEN |
| Zulassungsgegenstand und Verwendungszweck<br><br>*Generic type and use of construction product* | Kraftkontrolliert spreizender Dübel aus galvanisch verzinktem Stahl in den Größen M6, M8, M10, M12 und M16 zur Verankerung im Beton<br>*Torque controlled expansion anchor made of galvanised steel of sizes M6, M8, M10, M12 and M16 for use in concrete* |
| Geltungsdauer: vom<br>*Validity: from*<br>bis<br>*to* | 8 March 2010<br><br>8 March 2015 |
| Herstellwerk<br>*Manufacturing plant* | Tecfi S.p.A. Italy |

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| Diese Zulassung umfasst<br>*This Approval contains* | 16 Seiten einschließlich 9 Anhänge<br>*16 pages including 9 annexes* |

## I LEGAL BASES AND GENERAL CONDITIONS

1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998[4], as amended by law of 31 October 2006[5];
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6];
- Guideline for European technical approval of "Metal anchors for use in concrete - Part 2: Torque controlled expansion anchors ", ETAG 001-02.

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 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 product and intended use

### 1.1 Definition of the construction product

The Tecfi High Performance anchor HVE Rock is an anchor made of galvanised steel of sizes M6, M8, M10, M12 and M16 which is placed into a drilled hole and anchored by torque-controlled expansion.

An illustration of the product and intended use is given in Annex 1.

### 1.2 Intended use

The anchor is intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106 EEC shall be fulfilled and failure of anchorages made with these products would cause risk to human life and/or lead to considerable economic consequences.

The anchor may be used for anchorages with requirements related to resistance to fire.

The anchor is to be used only for anchorages subject to static or quasi-static loading in reinforced or unreinforced normal weight concrete of strength classes C20/25 at minimum and C50/60 at most according to EN 206:2000-12.

It may be anchored in cracked and non-cracked concrete.

The anchor may only be used in structures subject to dry internal conditions.

The provisions made in this European technical approval are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

## 2 Characteristics of the product and methods of verification

### 2.1 Characteristics of the product

The anchor corresponds to the drawings and provisions given in Annexes 3 and 4. The characteristic material values, dimensions and tolerances of the anchor not given in Annexes 3 and 4 shall correspond to the respective values laid down in the technical documentation[7] of this European technical approval.

Regarding the requirements concerning safety in case of fire it is assumed that the anchor meets the requirements of class A1 in relation to reaction to fire in accordance with the stipulations of the Commission decision 96/603/EC, amended by 2000/605/EC.

The characteristic values for the design of anchorages are given in Annexes 6 and 7.

The characteristic values for the design of anchorages regarding resistance to fire are given in the Annexes 8 and 9. They are valid for use in a system that is required to provide a specific fire resistance class.

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7 The technical documentation of this European technical approval is deposited at the Deutsches Institut für Bautechnik and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

Each expansion sleeve of the anchor is marked with the identifying mark of the producer, the trade name, the anchor diameter and the size of thread according to Annex 3. Each distance sleeve is marked with the anchor diameter, Anchor length and maximum thickness of the fixture according to Annex 3.

The anchor shall only be packaged and supplied as a complete unit.

## 2.2 Methods of verification

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 has been made in accordance with the "Guideline for European technical approval of Metal Anchors for Use in Concrete", Part 1 "Anchors in general" and Part 2 "Torque-controlled expansion anchors", on the basis of Option 1.

The assessment of the anchor for the intended use in relation to the requirements for resistance to fire has been made in accordance with the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire".

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

# 3 Evaluation and attestation of conformity and CE marking

## 3.1 System of attestation of conformity

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

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

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

(b) Tasks for the approved body:
  (3) initial type-testing of the product;
  (4) initial inspection of factory and of factory production control;
  (5) continuous surveillance, assessment and approval of factory production control.

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

## 3.2 Responsibilities

3.2.1 Tasks of the manufacturer

3.2.1.1 Factory production control

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

8 Official Journal of the European Communities L 254 of 08.10.1996.

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

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

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

3.2.1.2 Other tasks of 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 of approved bodies

The approved body shall perform the

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

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

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

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

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

## 3.3 CE marking

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

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

9 The control plan is a confidential part of the documentation of the European technical approval, but not published together with the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity.
See section 3.2.2.

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

### 4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed data/information, deposited with the 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 the Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

### 4.2 Design of anchorages

The fitness of the anchor for the intended use is given under the following conditions:

The anchorages are designed in accordance with the "Guideline for European technical approval of Metal Anchors for Use in Concrete", Annex C, Method A, under the responsibility of an engineer experienced in anchorages and concrete work.

Verifiable calculation notes and drawings are taking account of the loads to be anchored.

The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports).

The design of anchorages under fire exposure has to consider the conditions given in the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire". The relevant characteristic anchor values are given in Annexes 8 and 9. The design method covers anchors with a fire attack from one side only. If the fire attack is from more than one side, the design method may be taken only, if the edge distance of the anchor is $c \geq 300$ mm.

Local spalling is possible at fire attack. To avoid any influence of the spalling on the anchorage, the concrete member must be designed according to EN 1992-1-2:2004. The members shall be made of concrete with quartzite additives and have to be protected from direct moisture; and the moisture content of the concrete has to be like in dry internal conditions respectively. The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value in the approval.

### 4.3 Installation of anchors

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

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site,
- Use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor,
- Anchor installation in accordance with the manufacturer’s specifications and drawings and using the appropriate tools,
- Checks before placing the anchor to ensure that the strength class of the concrete in which the anchor is to be placed is in the range given and is not lower than that of the concrete to which the characteristic loads apply,
- Check of concrete being well compacted, e.g. without significant voids,
- Edge distances and spacing not less than the specified values without minus tolerances,
- Positioning of the drill holes without damaging the reinforcement,

- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not in the direction of load application,
- Cleaning of the hole of drilling dust,
- Anchor installation such that the effective anchorage depth is complied with. This compliance is ensured when the embedment mark of the anchor does no more exceed the concrete surface,
- Application of the torque moment given in Annex 3 using a calibrated torque wrench.

## 5 Indications to the manufacturer

The manufacturer is responsible to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to and 4.2 and 4.3 is given to those who are concerned. This information may be made by reproduction of the respective parts of the European technical approval. In addition all installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

The minimum data required are:

- Diameter of drill bit,
- Thread diameter,
- Maximum thickness of the fixture,
- Minimum effective anchorage depth,
- Minimum hole depth,
- Torque moment,
- Information on the installation procedure, including cleaning of the hole, preferably by means of an illustration,
- Reference to any special installation equipment needed,
- Identification of the manufacturing batch.

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

Dipl.-Ing. Georg Feistel
Head of Division Construction Engineering
of Deutsches Institut für Bautechnik
Berlin, 8 March 2010

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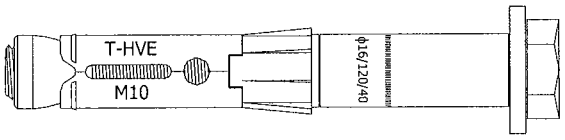
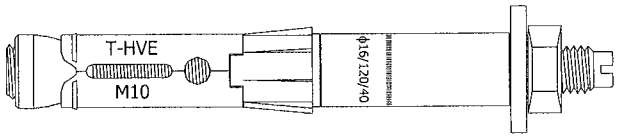
**Anchor type HVE01 with hexagon head screw**



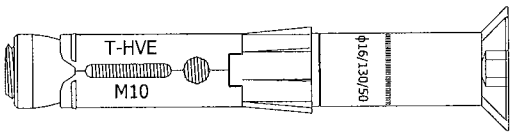

**HVE01 (M6-M16)**

**Anchor type HVE02 with threaded stud**



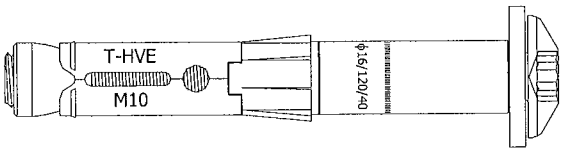

**HVE02 (M8)**

**Anchor type HVE03 with countersunk washer and flat countersunk head screw**

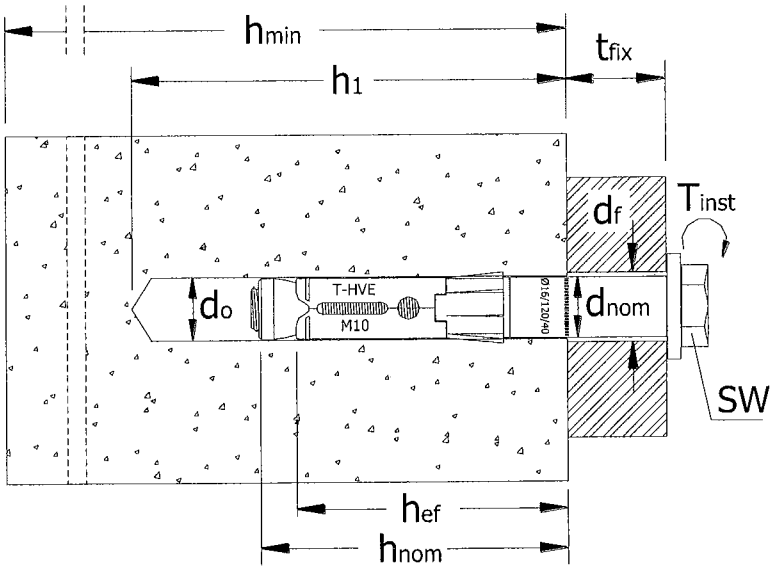



**HVE03 (M8)**

**Anchor type HVE04 with mushroom head screw**




**HVE04 (M8)**

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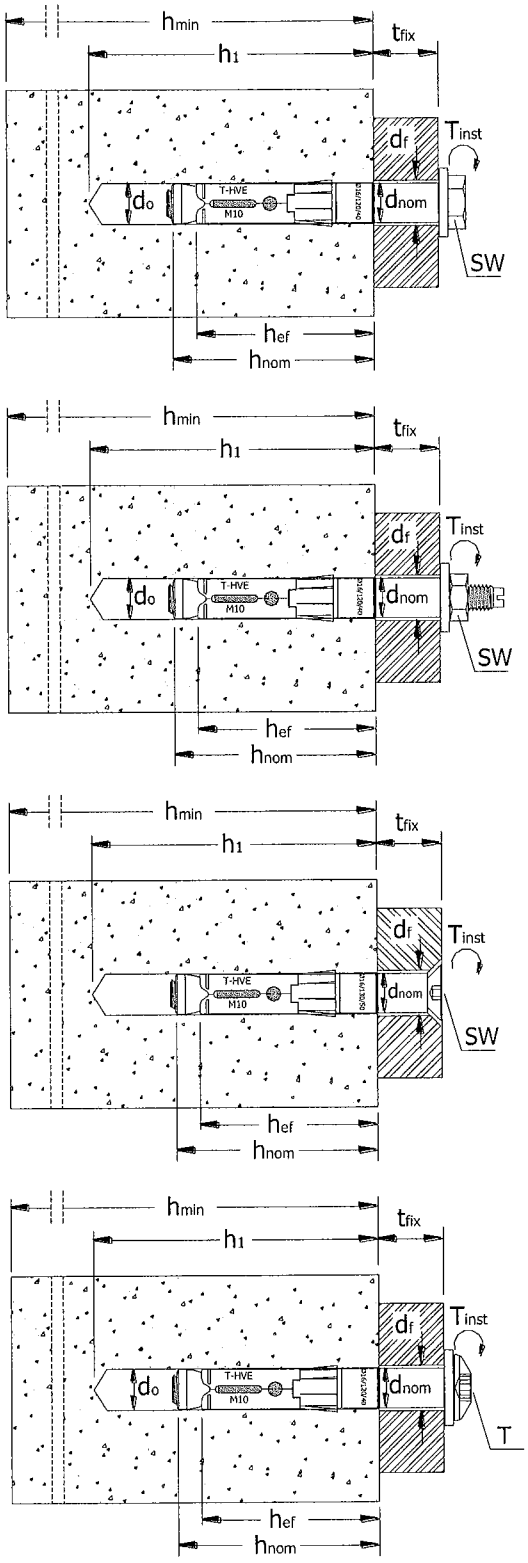
| **Tecfi High Performance anchor HVE Rock** | **Annex 1** of European Technical Approval **ETA - 10/0060** |
| **Product and intended use** | |

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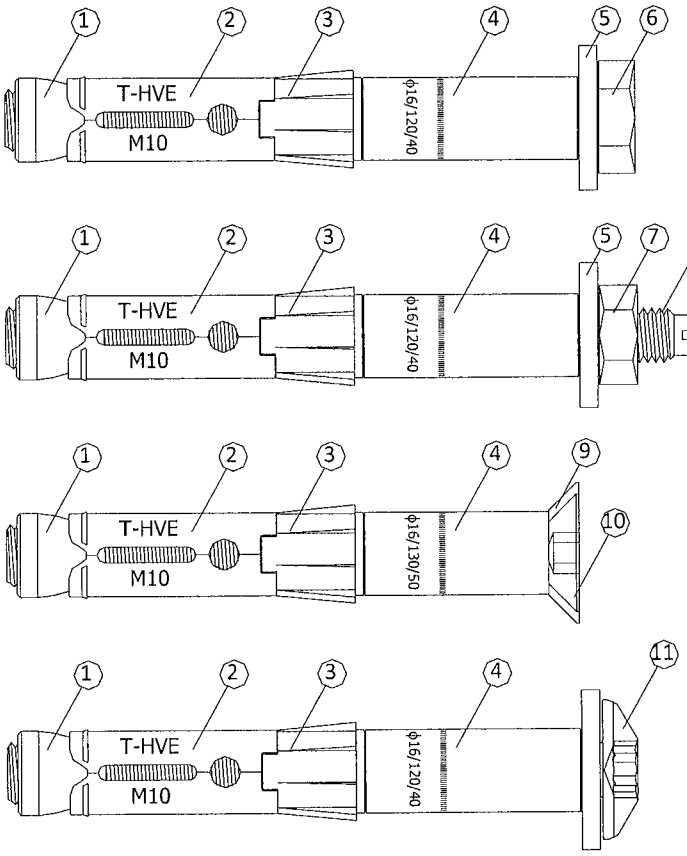
| **Tecfi High Performance anchor HVE Rock** | **Annex 2** of European Technical Approval **ETA- 10/0060** |
| **Intended use** | |




**Marking**

**Expansion sleeve :**

- Identifiyng mark of producer
- Trade name
- Anchor diameter
- Screw diameter

e.g : T-HVE
ϕ16
M10

**Distance sleeve :**

- Anchor diameter
- Anchor length
- Maximum thickness of the fixture

e.g.: ϕ16/120/40

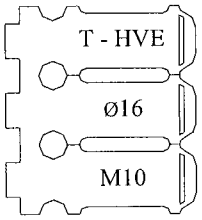



**Table 1 : Designation of anchor parts and materials**

| Part | Description | Materials galvanised ≥ 5µm according to ISO 4042 |
|---|---|---|
| 1 | Conical nut | Steel, Strength class 8, EN ISO 898-2 [1)] |
| 2 | Expansion sleeve | Steel, EN 10130 - EN 10111 |
| 3 | Nylon ring | Polyamide |
| 4 | Distance sleeve | Steel, EN 10263 |
| 5 | Washer | Steel, UNI EN 10083 |
| 6 | Hexagonal head screw | Steel, Strength class 8.8, EN ISO 898-1 |
| 7 | Hexagonal nut | Steel, Strength class 8, EN ISO 898-2 |
| 8 | Threaded stud | Steel, Strength class 8.8, EN SO 898-1 |
| 9 | Countersunk washer | Steel, EN 10083 |
| 10 | Flat Countersunk head screw | Steel, Strength class 8.8, ISO 898-1 |
| 11 | Mushroom head screw | Steel, Strength class 8.8, ISO 898-1 |

[1)] Functional coating

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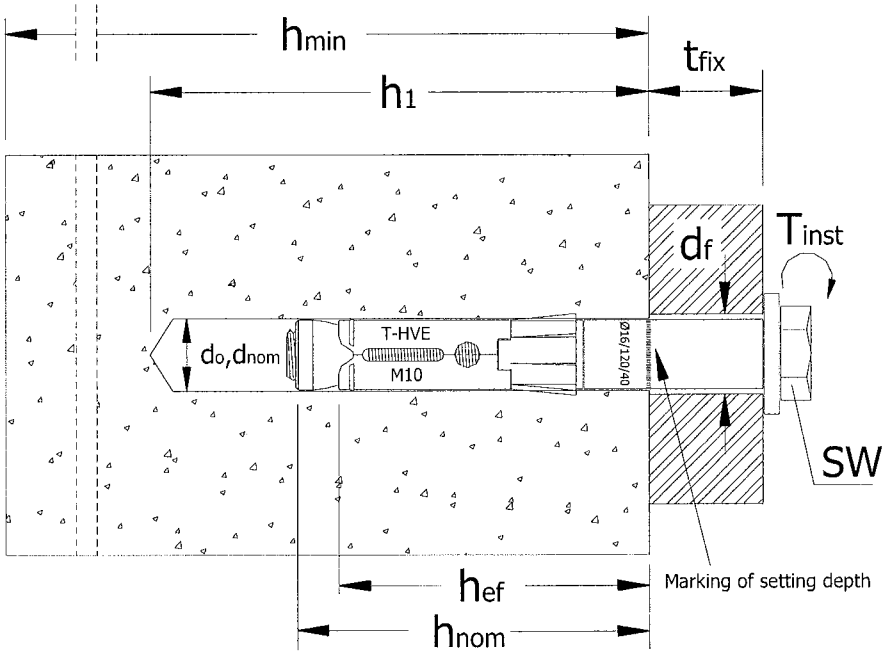
| **Tecfi High Performance anchor HVE Rock** | **Annex 3** of European Technical Approval **ETA - 10/0060** |
| **Designation of anchor parts and Materials** | |

**Table 2 : Installation parameters**

| Denomination | | HVE M6 | HVE M8[2)] | HVE M10 | HVE M12 | HVE M16 |
|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $d_o$ = [mm] | 10 | 12 | 16 | 18 | 24 |
| Cutting diameter of drill bit | $d_{cut} \leq$ [mm] | 10,45 | 12,50 | 16,50 | 18,50 | 24,55 |
| Effective anchorage depth | $h_{ef}$ = [mm] | 55 | 60 | 70 | 90 | 105 |
| Depth of drill hole | $h_1$ = [mm] | 80 | 90 | 100 | 120 | 140 |
| Diameter of clearance in the fixture | $d_f$ = [mm] | 12 | 14 | 18 | 20 | 26 |
| Overall anchor embedment depth in the concrete | $h_{nom}$ = [mm] | 65 | 70 | 80 | 100 | 120 |
| Required torque moment | $T_{inst}$ = [Nm] | 15 | 30 | 50 | 100 | 160 |
| Outside diameter of anchor | $d_{nom}$ = [mm] | 10 | 12 | 16 | 18 | 24 |
| Minimum thickness of concrete member | $h_{min}$ = [mm] | 110 | 120 | 140 | 180 | 210 |
| Minimum edge distance [1)] | $c_{min}$ = [mm] | 70 | 100 | 90 | 175 | 180 |
| | $s \geq$ [mm] | 110 | 160 | 175 | 255 | 290 |
| Minimum spacing [1)] | $s_{min}$ = [mm] | 55 | 110 | 80 | 135 | 130 |
| | $c \geq$ [mm] | 110 | 145 | 120 | 220 | 240 |

[1)] Applied for cracked and uncraked concrete.

[2)] Valid for all head type HVE01 - HVE04.

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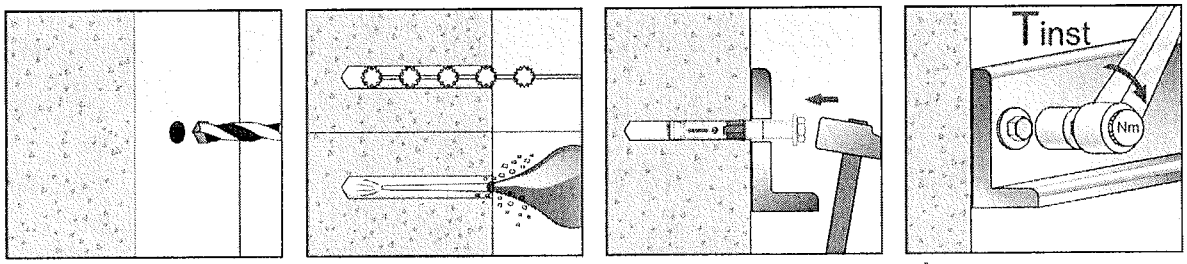
| **Tecfi High Performance anchor HVE Rock** | **Annex 4** of European Technical Approval **ETA- 10/0060** |
| **Installation parameters, minimum edge distance and spacing** | |

**Table 3 : Installation parameters**

| | Denomination | | HVE M6 | HVE M8 | HVE M10 | HVE M12 | HVE M16 |
|---|---|---|---|---|---|---|---|
| HVE 01 | Thickness of fixture | $t_{fix,min}$ = [mm] | 5 | 10 | 20 | 20 | 20 |
| | | $t_{fix,max}$ = [mm] | 55 | 70 | 80 | 100 | 100 |
| | Wrench size | SW = [mm] | 10 | 13 | 17 | 19 | 24 |
| HVE 02 | Thickness of fixture | $t_{fix,min}$ = [mm] | | 10 | | | |
| | | $t_{fix,max}$ = [mm] | | 70 | | | |
| | Wrench size | SW = [mm] | | 13 | | | |
| HVE 03 | Thickness of fixture | $t_{fix,min}$ = [mm] | | 15 | | | |
| | | $t_{fix,max}$ = [mm] | | 55 | | | |
| | Size of hexagonal socket | SW = [mm] | | 5 | | | |
| HVE 04 | Thickness of fixture | $t_{fix,min}$ = [mm] | | 10 | | | |
| | | $t_{fix,max}$ = [mm] | | 50 | | | |
| | 6 lobe recess | T | | 40 | | | |




a b c d

a. Make a drill hole with a hammer drilling.

b. Clean the drill hole with a brush.

c. Put the anchor into the drill hole.

d. Apply the required installation torque.

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| **Tecfi High Performance anchor HVE Rock** | **Annex 5** of European Technical Approval **ETA - 10/0060** |
| **Installation parameters and installation instruction** | |

**Table 4 : Design Method A, Characteristic values to tension loads**

| Type of anchor / Size | | | HVE M6 | HVE M8[4)] | HVE M10 | HVE M12 | HVE M16 |
|---|---|---|---|---|---|---|---|
| **Steel Failure** | | | | | | | |
| Characteristic Resistance | $N_{Rk,s}$ | [kN] | 16 | 29 | 46 | 67 | 125 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | | 1,5 | | | | |
| **Pull-out failure** | | | | | | | |
| Effective embedment depth | $h_{ef}$ | [mm] | 55 | 60 | 70 | 90 | 105 |
| Characteristic Resistance in uncracked concrete C20/25 | $N_{Rk,p}$ | [kN] | 16 | 16 | 20 | 35 | 45 |
| Characteristic Resistance in cracked concrete C20/25 | | | 5 | 6 | 16 | 25 | 35 |
| Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete | $\Psi_c$ | C30/37 | 1,22 | | | | |
| | | C40/50 | 1,41 | | | | |
| | | C50/60 | 1,55 | | | | |
| Partial safety factor | $\gamma_{Mp}$ [1)] | | 1,5 [2)] | | | | |
| **Concrete cone failure and splitting failure** | | | | | | | |
| Effective embedment depth | $h_{ef}$ | [mm] | 55 | 60 | 70 | 90 | 105 |
| Spacing | $s_{cr,N}$ | [mm] | 165 | 180 | 210 | 270 | 315 |
| Edge distance | $c_{cr,N}$ | [mm] | 85 | 90 | 105 | 135 | 160 |
| Spacing (splitting) | $s_{cr,sp}$ | [mm] | 220 | 320 | 240 | 370 | 390 |
| Edge distance (splitting) | $c_{cr,sp}$ | [mm] | 110 | 160 | 120 | 185 | 195 |
| Partial safety factor | $\gamma_{Mp}$ [1)] | | 1,5 [2)] | | | | |

[1)] In absence of other national regulations.

[2)] The partial safety factor $\gamma_2$=1 is included.

[3)] Valid for all head type HVE01 - HVE04.

**Table 5 : Displacements under tension loads**

| Type of anchor / Size | | | HVE M6 | HVE M8[1)] | HVE M10 | HVE M12 | HVE M16 |
|---|---|---|---|---|---|---|---|
| Service tension load in uncracked concrete C20/25 | N | [kN] | 7,6 | 7,6 | 9,5 | 16,7 | 21,4 |
| Displacements | $\delta_{N0}$ | [mm] | 1,3 | 1,5 | 1,0 | 1,3 | 1,8 |
| | $\delta_{N\infty}$ | [mm] | 1,3 | 1,5 | 1,0 | 1,3 | 1,8 |
| Service tension load in cracked concrete C20/25 | N | [kN] | 2,4 | 2,9 | 7,6 | 11,9 | 16,7 |
| Displacements | $\delta_{N0}$ | [mm] | 1,0 | 0,7 | 1,0 | 1,2 | 1,5 |
| | $\delta_{N\infty}$ | [mm] | 1,6 | 1,3 | 1,6 | 1,7 | 1,5 |

[1)] Valid for all head type HVE01 - HVE04.

**Table 6 : Design Method A, Characteristic values to shear loads**

| Type of anchor / Size | | | HVE M6 | HVE M8[3)] | HVE M10 | HVE M12 | HVE M16 |
|---|---|---|---|---|---|---|---|
| **Steel Failure without level arm** | | | | | | | |
| Characteristic Resistance | $V_{Rk,s}$ | [kN] | 16 | 25 | 43 | 58 | 107 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | | 1,45 | | | | |
| **Steel Failure with level arm** | | | | | | | |
| Characteristic bending moment | $M^0_{Rk,s}$ | [Nm] | 12 | 30 | 60 | 105 | 266 |
| Partial safety factor | $\gamma_{Ms}$ [1)] | | 1,45 | | | | |
| **Concrete pryout failure** | | | | | | | |
| Effective embedment depth | $h_{ef}$ | [mm] | 55 | 60 | 70 | 90 | 105 |
| Factor in equation (5.6) of the guideline Annex C, Section 5.2.3.3 | K | | 1 | 2 | 2 | 2 | 2 |
| Partial safety factor | $\gamma_{Mp}$ [1)] | | 1,5 [2)] | | | | |
| **Concrete edge failure** | | | | | | | |
| Effective anchorage legth | $l_{ef}$ | [mm] | 55 | 60 | 70 | 90 | 105 |
| Effective external diameter anchor | $d_{nom}$ | [mm] | 10 | 12 | 16 | 18 | 24 |
| Partial safety factor | $\gamma_{Mc}$ [1)] | | 1,5 [2)] | | | | |

[1)] In absence of other national regulations.

[2)] The partial safety factor $\gamma_2$=1,0 is included.

[3)] Valid for all head type HVE01 - HVE04.

**Table 7 : Displacements under shear loads**

| Type of anchor / Size | | | HVE M6 | HVE M8[1)] | HVE M10 | HVE M12 | HVE M16 |
|---|---|---|---|---|---|---|---|
| Service shear load in cracked and uncracked concrete C20/25 | V | [kN] | 7,7 | 12,3 | 21,0 | 23,3 | 52,5 |
| Displacements | $\delta_{N0}$ | [mm] | 2,4 | 2,6 | 2,5 | 3,0 | 4,0 |
| | $\delta_{N\infty}$ | [mm] | 3,6 | 3,9 | 3,8 | 4,5 | 6,0 |

[1)] Valid for all head type HVE01 - HVE04.

**Tecfi High Performance anchor HVE Rock**

**Design Method A,**
**Characteristic values of resistance and displacement under shear loads**

**Annex 7**
of European Technical Approval
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**Table 8 : Characteristic values to tension loads under fire exposure in cracked and uncracked concrete C20/25 to C50/60 for M6 – M16**

| **Duration of fire resistance = 30min, anchor type HVE** | | | **M6** | **M8**[1)] | **M10** | **M12** | **M16** |
|---|---|---|---|---|---|---|---|
| **Steel Failure** | | | | | | | |
| Characteristic Resistance | $N_{Rk,s,fi,30}$ | [kN] | 0,2 | 0,4 | 0,9 | 1,7 | 3,1 |
| **Pull-out failure** | | | | | | | |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,p,fi,30}$ | [kN] | 1,3 | 1,5 | 4,0 | 6,3 | 8,8 |
| **Concrete cone failure** | | | | | | | |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,c,fi,30}$ | [kN] | 4,0 | 5,0 | 7,4 | 13,8 | 20,3 |
| **Duration of fire resistance = 60min, anchor type HVE** | | | **M6** | **M8**[1)] | **M10** | **M12** | **M16** |
| **Steel Failure** | | | | | | | |
| Characteristic Resistance | $N_{Rk,s,fi,60}$ | [kN] | 0,2 | 0,3 | 0,8 | 1,3 | 2,4 |
| **Pull-out failure** | | | | | | | |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,p,fi,60}$ | [kN] | 1,3 | 1,5 | 4,0 | 6,3 | 8,8 |
| **Concrete cone failure** | | | | | | | |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,c,fi,60}$ | [kN] | 4,0 | 5,0 | 7,4 | 13,8 | 20,3 |
| **Duration of fire resistance = 90min, anchor type HVE** | | | **M6** | **M8**[1)] | **M10** | **M12** | **M16** |
| **Steel Failure** | | | | | | | |
| Characteristic Resistance | $N_{Rk,s,fi,90}$ | [kN] | 0,1 | 0,3 | 0,6 | 1,1 | 2,0 |
| **Pull-out failure** | | | | | | | |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,p,fi,90}$ | [kN] | 1,3 | 1,5 | 4,0 | 6,3 | 8,8 |
| **Concrete cone failure** | | | | | | | |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,c,fi,90}$ | [kN] | 4,0 | 5,0 | 7,4 | 13,8 | 20,8 |
| **Duration of fire resistance = 120min, anchor type HVE** | | | **M6** | **M8**[1)] | **M10** | **M12** | **M16** |
| **Steel Failure** | | | | | | | |
| Characteristic Resistance | $N_{Rk,s,fi,120}$ | [kN] | 0,1 | 0,2 | 0,5 | 0,8 | 1,6 |
| **Pull-out failure** | | | | | | | |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,p,fi,120}$ | [kN] | 1,0 | 1,2 | 3,2 | 5,0 | 7,0 |
| **Concrete cone failure** | | | | | | | |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,c,fi,120}$ | [kN] | 3,2 | 4,0 | 5,9 | 11,1 | 16,3 |
| Spacing | $S_{cr,N}$ | [mm] | **4 x $h_{ef}$** | | | | |
| | $s_{min}$ | | 55 | 110 | 80 | 135 | 130 |
| Edge distance | $c_{cr,N}$ | | **2 x $h_{ef}$** | | | | |
| | $c_{min}$ | | $c_{min}$ = 2x$h_{ef}$; If fire attack comes from more then one side, the edge distance of the anchor has to be ≥ 300mm or ≥ 2 x $h_{ef}$ | | | | |

[1)] Valid for all head type HVE01 - HVE04.

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{m,fi}$ = 1,0 is recommended

| | |
|---|---|
| **Tecfi High Performance anchor HVE Rock** | **Annex 8** of European Technical Approval **ETA- 10/0060** |
| **Characteristic values of tension load under fire exposure** | |

**Table 9 : Characteristic values to shear loads under fire exposure in cracked and uncracked concrete C20/25 to C50/60 for M6 – M16**

| **Duration of fire resistance = 30min, anchor type HVE** | | | **M6** | **M8**[1)] | **M10** | **M12** | **M16** |
|---|---|---|---|---|---|---|---|
| **Shear load without lever arm** | | | | | | | |
| Characteristic resi stance | $V_{Rk,s,fi,30}$ | [kN] | 0,3 | 0,5 | 1,2 | 2,1 | 3,9 |
| **Shear load with lever arm** | | | | | | | |
| Characteristic bending resistance | $M_{Rk,s,fi,30}$ | [Nm] | 0,2 | 0,4 | 1,1 | 2,6 | 6,7 |
| **Duration of fire resistance = 60min, anchor type HVE** | | | **M6** | **M8**[1)] | **M10** | **M12** | **M16** |
| **Shear load without lever arm** | | | | | | | |
| Characteristic resi stance | $V_{Rk,s,fi,60}$ | [kN] | 0,3 | 0,4 | 1,0 | 1,6 | 2,9 |
| **Shear load with lever arm** | | | | | | | |
| Characteristic bending resistance | $M_{Rk,s,fi,60}$ | [Nm] | 0,1 | 0,3 | 1,0 | 2,0 | 5,0 |
| **Duration of fire resistance = 90min, anchor type HVE** | | | **M6** | **M8**[1)] | **M10** | **M12** | **M16** |
| **Shear load without lever arm** | | | | | | | |
| Characteristic resi stance | $V_{Rk,s,fi,90}$ | [kN] | 0,2 | 0,3 | 0,8 | 1,4 | 2,5 |
| **Shear load with lever arm** | | | | | | | |
| Characteristic bending resistance | $M_{Rk,s,fi,90}$ | [Nm] | 0,1 | 0,3 | 0,8 | 1,7 | 4,3 |
| **Duration of fire resistance = 120min, anchor type HVE** | | | **M6** | **M8**[1)] | **M10** | **M12** | **M16** |
| **Shear load without lever arm** | | | | | | | |
| Characteristic resi stance | $V_{Rk,s,fi,120}$ | [kN] | 0,2 | 0,2 | 0,6 | 1,0 | 1,9 |
| **Shear load with lever arm** | | | | | | | |
| Characteristic bending resistance | $M_{Rk,s,fi,120}$ | [Nm] | 0 | 0,2 | 0,6 | 1,3 | 3,3 |
| **Concrete pryout failure** | | | | | | | |
| The characteristic resistance $V_{rk,cp,fi,Ri}$ in concrete C20/25 to C50/60 is determined by: $\mathbf{V_{Rk,c,fi(90)} = k \times N_{Rk,c,fi(90)}}$ (≤ R90) and $\mathbf{V_{Rk,c,fi(120)} = k \times N_{Rk,c,fi(120)}}$ (up to R120) | | | | | | | |
| **Concrete edge failure** | | | | | | | |
| The characteristic resistance $V_{rk,cp,fi,Ri}$ in concrete C20/25 to C50/60 is determined by: $\mathbf{V^0_{Rk,c,fi(90)} = 0,25 \times V^0_{Rk,c}}$ (R30, R60, R90) and $\mathbf{V^0_{Rk,c,fi(120)} = 0,20 \times V^0_{Rk,c}}$ (R120) with $V^0_{Rk,c}$ as an initial value of the characteristic resistance of a single anchor in cracked concrete C20/25 | | | | | | | |

[1)] Valid for all head type HVE01 - HVE04.

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{m,fi}$ = 1,0 is recommended