

# HVE



Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

**ETA-10/0060**  
**of 11 June 2015**

English translation prepared by DIBt - Original version in German language

### General Part

Technical Assessment Body issuing the  
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

Tecfi HVE Rock

Product family  
to which the construction product belongs

Torque controlled expansion anchor for use in concrete

Manufacturer

Tecfi S.p.A  
Strada Statale Appia, Km. 193  
81050 PASTORANO (CE)  
ITALIEN

Manufacturing plant

Tecfi S.p.A. Italy

This European Technical Assessment  
contains

15 pages including 3 annexes

This European Technical Assessment is  
issued in accordance with Regulation (EU)  
No 305/2011, on the basis of

Guideline for European technical approval of "Metal  
anchors for use in concrete", ETAG 001 Part 2: "Torque  
controlled expansion anchors", April 2013,  
used as European Assessment Document (EAD)  
according to Article 66 Paragraph 3 of Regulation (EU)  
No 305/2011.

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**Specific Part**

**1 Technical description of the product**

The Tecfi 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.  
 The product description is given in Annex A.

**2 Specification of the intended use in accordance with the applicable European Assessment Document**

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.  
 The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 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.

**3 Performance of the product and references to the methods used for its assessment**

**3.1 Mechanical resistance and stability (BWR 1)**

| Essential characteristic   | Performance   |
|--|---------------|
| Characteristic resistance for static and quasi static action and seismic performance category C1 | See Annex C 1 |
| Displacements  | See Annex C 4 |

**3.2 Safety in case of fire (BWR 2)**

| Essential characteristic | Performance                                 |
|--------------------------|---|
| Reaction to fire         | Anchorage satisfy requirements for Class A1 |
| Resistance to fire       | See Annex C 2 / C 3                         |

**3.3 Hygiene, health and the environment (BWR 3)**

Not applicable.

**3.4 Safety in use (BWR 4)**

The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

**3.5 Protection against noise (BWR 5)**

Not applicable.

**3.6 Energy economy and heat retention (BWR 6)**

Not applicable.

**3.7 Sustainable use of natural resources (BWR 7)**

The sustainable use of natural resources was not investigated.

English translation prepared by DIBt

**3.8 General aspects**

The verification of durability is part of testing the essential characteristics. Durability is only ensured if the specifications of intended use according to Annex B are taken into account.

**4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base**

According to Decision of the Commission of 24 June 1996 (96/582/EC) (OJ L 254 of 08.10.96 p. 62-65), the system of assessment and verification of constancy of performance (see Annex V and Article 65 Paragraph 2 to Regulation (EU) No 305/2011) given in the following table applies.

| Product   | Intended use   | Level or class | System |
|---|--|----------------|--------|
| Metal anchors for use in concrete (heavy-duty type) | For fixing and/or supporting concrete structural elements or heavy units such as cladding and suspended ceilings | —              | 1      |

**5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document**

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 11 June 2015 by Deutsches Institut für Bautechnik

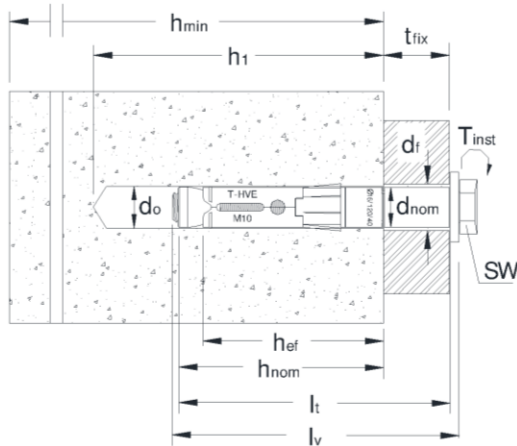
Andreas Kummerow  
p.p. Head of Department

*beglaubigt:*  
Lange

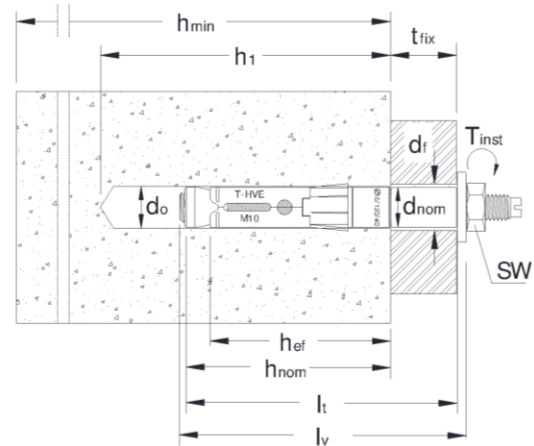
English translation prepared by DIBt

### Installed conditions

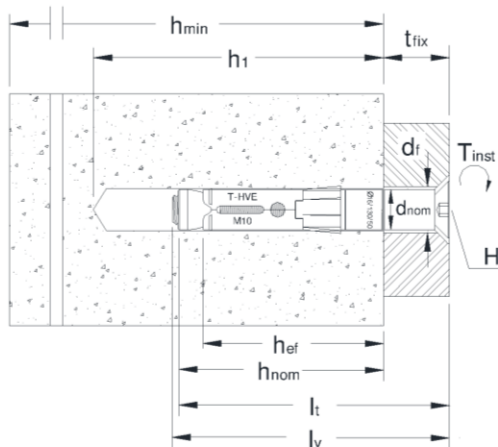
**HVE01**



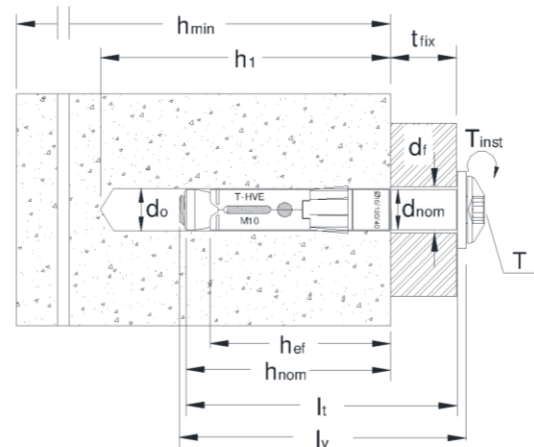
**HVE02**



**HVE03**



**HVE04**



**Designation**

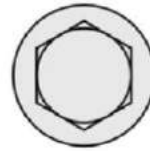
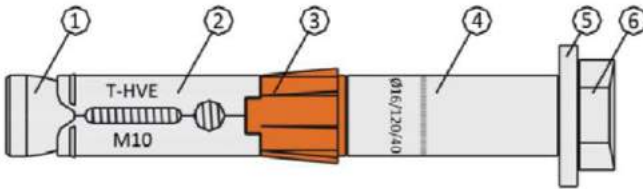
|            |   |
|------------|---|
| $d_{nom}$  | Outside diameter of the anchor                |
| $T_{inst}$ | Required torque moment                        |
| $t_{fix}$  | Thickness of the fixtures                     |
| $d_0$      | Diameter of the drill hole                    |
| $d_f$      | Diameter of the clearance hole in the fixture |
| $h_{min}$  | Minimum thickness of the concrete member      |
| $h_{nom}$  | Overall anchor embedment depth                |
| $h_{ef}$   | Anchorage depth                               |
| $l_t$      | Anchor length                                 |
| $l_v$      | Bolt length                                   |
| T          | Hexalobular socket number                     |
| SW         | Wrench size/Socket size                       |
| H          | Hexagonal socket                              |

**Tecfi HVE Rock**

**Product description**  
Installed condition

**Annex A1**

**Anchor type HVE01 with hexagon head screw**

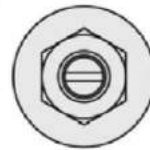
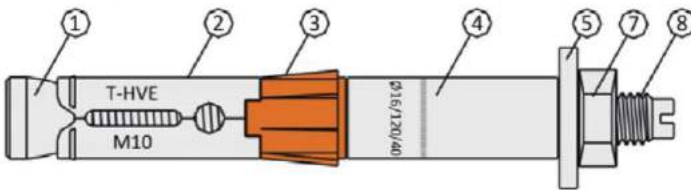


**HVE01**  
(M6-M16)

**Marking**

- Expansion sleeve :**
- Identifying mark of producer
  - Trade name
  - Anchor diameter
  - Screw diameter
- e.g : T-HVE  
Ø16  
M10

**Anchor type HVE02 with threaded stud**

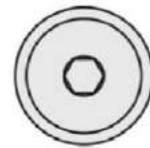
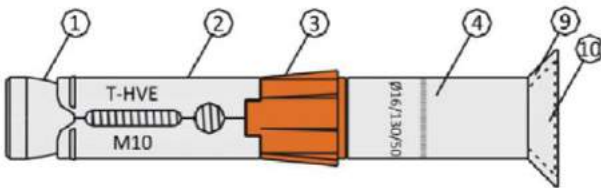


**HVE02**  
(M6-M16)

**Distance sleeve :**

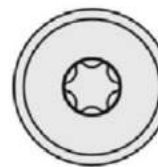
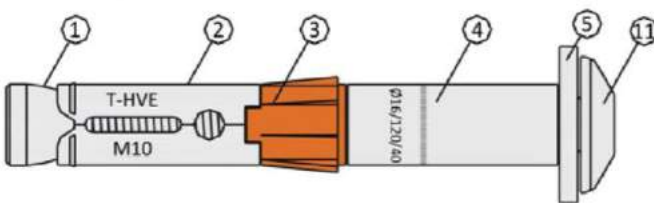
- Anchor diameter
  - Anchor length
  - Maximum thickness of the fixture
- e.g.: Ø16/120/40

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

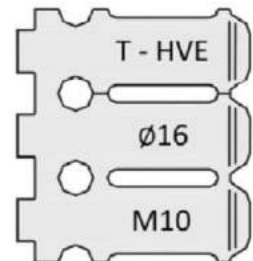


**HVE03**  
(M6-M12)

**Anchor type HVE04 with mushroom head screw**



**HVE04**  
(M8-M10)



**Table A1: Materials**

| ITEM | Description  | Finishing  |
|------|--|--|
| 1    | Zinc plated conical steel nut  | Materials galvanised $\geq 5$ [ $\mu\text{m}$ ] according to ISO 4042:1999 |
| 2    | Zinc plated expansion steel sleeve (marking: T-HVE / bolt size, e.g. M10)                    |  |
| 3    | Nylon 6.6 cylinder with helix, red brick color   |  |
| 4    | Zinc plated steel extension (marking: $d_{\text{nom}}/l_t/t_{\text{fix}}$ , e.g. Ø16/120/40) |  |
| 5    | Zinc plated steel washer   |  |
| 6    | Zinc plated steel hexagonal head bolt, class 8.8 according to ISO 898-1:2012                 |  |
| 7    | Zinc plated steel hexagonal nut, class 8 according to ISO 898-2:2012                         |  |
| 8    | Zinc plated steel threaded stud, class 8.8 according to ISO 898-1:2012                       |  |
| 9    | Zinc plated steel countersunk washer, according to EN 10083-6:2006                           |  |
| 10   | Zinc plated steel flat countersunk head screw, class 8.8 according to ISO 898-1:2012         |  |
| 11   | Zinc plated steel mushroom head screw, class 8.8 according to ISO 898-1:2012                 |  |

**Tecfi HVE Rock**

**Product description**  
Anchor types and components, Materials

**Annex A2**

English translation prepared by DIBt

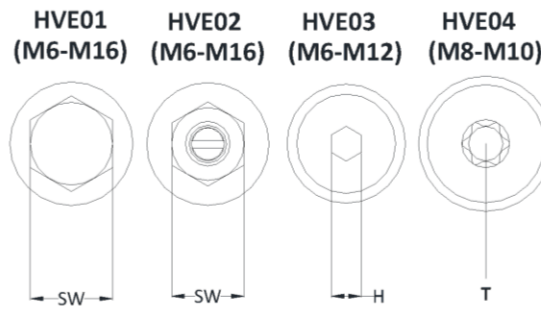


Table A2: HVE01 dimensions

| Item      | Outside diameter of anchor [mm] | Outside diameter of metric thread [mm] | Length range [mm] | Maximum thickness of fixture range [mm] |
|-----------|---------------------------------|--|-------------------|---|
| HVE01-M6  | 10                              | 6                                      | 70 - 120          | 5 - 15                                  |
| HVE01-M8  | 12                              | 8                                      | 80 - 140          | 10 - 70                                 |
| HVE01-M10 | 16                              | 10                                     | 100 - 160         | 20 - 80                                 |
| HVE01-M12 | 18                              | 12                                     | 120 - 200         | 20 - 100                                |
| HVE01-M16 | 24                              | 16                                     | 140 - 220         | 20 - 100                                |

Table A3: HVE02 dimensions

| Item      | Outside diameter of anchor [mm] | Outside diameter of metric thread [mm] | Length range [mm] | Maximum thickness of fixture range [mm] |
|-----------|---------------------------------|--|-------------------|---|
| HVE02-M6  | 10                              | 6                                      | 70 - 120          | 5 - 15                                  |
| HVE02-M8  | 12                              | 8                                      | 80 - 140          | 10 - 70                                 |
| HVE02-M10 | 16                              | 10                                     | 100 - 160         | 20 - 80                                 |
| HVE02-M12 | 18                              | 12                                     | 120 - 200         | 20 - 100                                |
| HVE02-M16 | 24                              | 16                                     | 140 - 220         | 20 - 100                                |

Table A4: HVE03 dimensions

| Item      | Outside diameter of anchor [mm] | Outside diameter of metric thread [mm] | Length range [mm] | Maximum thickness of fixture range [mm] |
|-----------|---------------------------------|--|-------------------|---|
| HVE03-M6  | 10                              | 6                                      | 85 - 125          | 20 - 60                                 |
| HVE03-M8  | 12                              | 8                                      | 85 - 125          | 15 - 55                                 |
| HVE03-M10 | 16                              | 10                                     | 110 - 130         | 30 - 50                                 |
| HVE03-M12 | 18                              | 12                                     | 120 - 140         | 20 - 40                                 |

Table A5: HVE04 dimensions

| Item      | Outside diameter of anchor [mm] | Outside diameter of metric thread [mm] | Length range [mm] |
|-----------|---------------------------------|--|-------------------|
| HVE04-M8  | 12                              | 8                                      | 80 - 120          |
| HVE04-M10 | 16                              | 10                                     | 100 - 120         |

Annex A3

Tecfi HVE Rock

Product description  
Anchors dimensions



### Specifications of intended use

**Anchorage subject to:**

- Static and quasi-static loads: all sizes
- Seismic action for Performance Category C1: all sizes
- Fire exposure: all sizes

**Base materials:**

- Reinforced or unreinforced normal weight concrete according to EN 206:2013.
- Strength classes C20/25 to C50/60 according to EN 206:2013.
- Non-cracked or cracked concrete

**Use conditions (Environmental conditions),**

- Anchorages subject to dry internal conditions

**Design:**

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages under static or quasi-static actions and under fire exposure are designed in accordance with:
  - ETAG 001, Annex C, design method A, Edition August 2010;
  - CEN TS CEN/TS 1992-4-1:2009;
- Anchorages under seismic actions (cracked concrete) are designed in accordance with:
  - EOTA Technical Report TR 045, Edition February 2013
  - Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure
  - Fastening in stand-off installation or with a grout layer are not allowed
- Anchorages under fire exposure are designed in accordance with:
  - ETAG 001, Annex C, design method A, Edition August 2010 and EOTA Technical Report TR 020, Edition May 2004
  - CEN/TS 1992-4: 2009, Annex D
  - It must be ensured that local spalling of the concrete cover does not occur

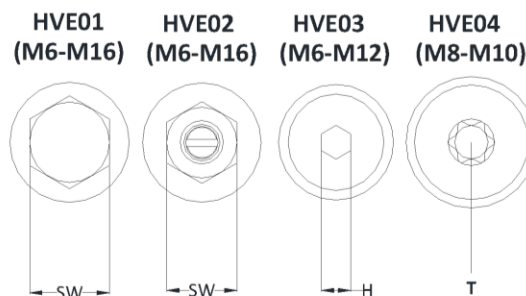
**Installation:**

- Hole drilling by rotary plus hammer mode
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- 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 hole is filled with high strength mortar and if under shear or oblique tension load it is not the direction of the load application.

|                                    |                 |
|------------------------------------|-----------------|
| <b>Tecfi HVE Rock</b>              | <b>Annex B1</b> |
| <b>Intended use Specifications</b> |                 |

**Table B1: Installation parameters**

| Sizes                                 |                     | HVE M6 | HVE M8 | 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 | $h_{nom} = [mm]$    | 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                 | $c_{min} = [mm]$    | 70     | 100    | 90      | 175     | 180     |
| Corresponding spacing                 | $s \geq [mm]$       | 110    | 160    | 175     | 255     | 290     |
| Minimum spacing                       | $s_{min} = [mm]$    | 55     | 110    | 80      | 135     | 130     |
| Corresponding edge distance           | $c \geq [mm]$       | 110    | 145    | 120     | 220     | 240     |




**Table B2: Wrenches, sockets and maximum thickness of fixture**

| Sizes                              |                      | M6 | M8 | M10 | M12 | M16 |
|------------------------------------|----------------------|----|----|-----|-----|-----|
| HVE 01 – Wrench size               | $SW = [mm]$          | 10 | 13 | 17  | 19  | 24  |
| HVE 01 – Thickness of fixture      | $t_{fix,max} = [mm]$ | 55 | 70 | 80  | 100 | 100 |
|                                    | $t_{fix,min} = [mm]$ | 5  | 10 | 20  | 20  | 20  |
| HVE 02 – Wrench size               | $SW = [mm]$          | 10 | 13 | 17  | 19  | 24  |
| HVE 02 – Thickness of fixture      | $t_{fix,max} = [mm]$ | 55 | 70 | 80  | 100 | 100 |
|                                    | $t_{fix,min} = [mm]$ | 5  | 10 | 20  | 20  | 20  |
| HVE 03 – Hexagonal socket size     | $H = [mm]$           | 4  | 5  | 6   | 8   | -   |
| HVE 03 – Thickness of fixture      | $t_{fix,max} = [mm]$ | 60 | 55 | 50  | 100 | -   |
|                                    | $t_{fix,min} = [mm]$ | 20 | 15 | 30  | 20  | -   |
| HVE 04 – Hexalobular socket number | $T = [-]$            | -  | 40 | 40  | -   | -   |
| HVE 04 – Thickness of fixture      | $t_{fix,max} = [mm]$ | -  | 50 | 40  | -   | -   |
|                                    | $t_{fix,min} = [mm]$ | -  | 10 | 20  | -   | -   |

**Tecfi HVE Rock**

**Intended use**

*Drill bit*

|  | Anchor size | Drill bit item code |
|---|-------------|---------------------|
|   | M6 / Ø10    | EO 01 08 210        |
|   | M8 / Ø12    | EO 01 10 210        |
|   | M10 / Ø16   | EO 01 16 210        |
|   | M12 / Ø18   | EO 01 18 210        |
|   | M16 / Ø24   | EO 01 24 210        |

*Blowing pump*

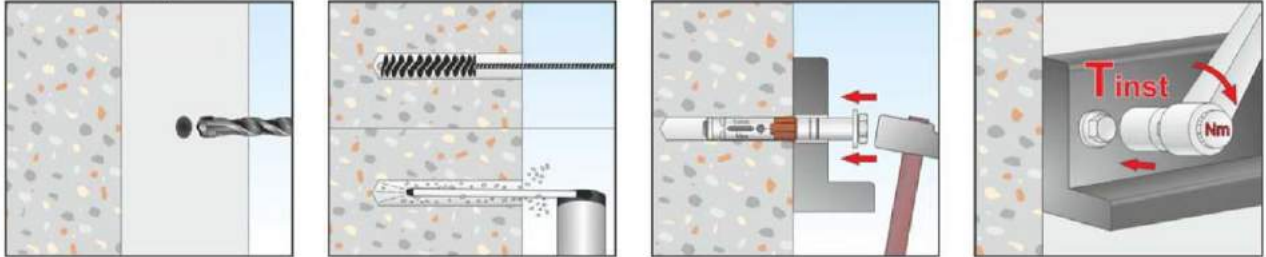


**Tecfi HVE Rock**

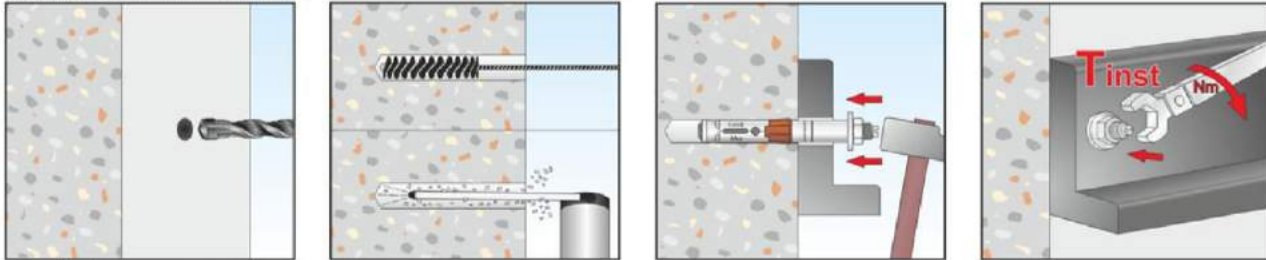
**Intended use**  
Cleaning and setting tools

**Annex B3**

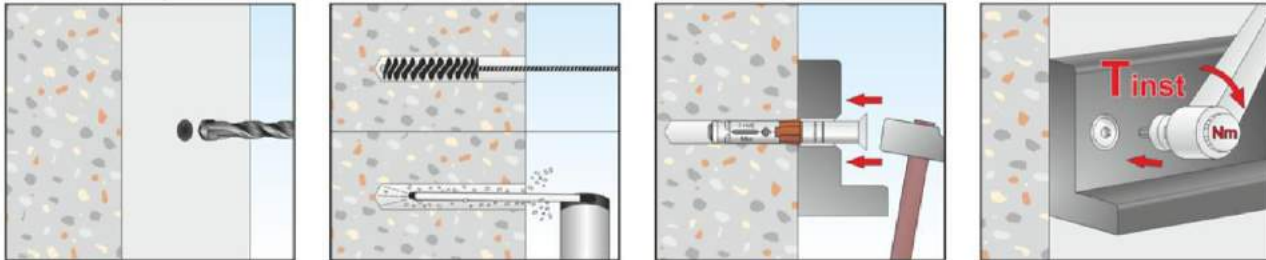
Installation sequence HVE01



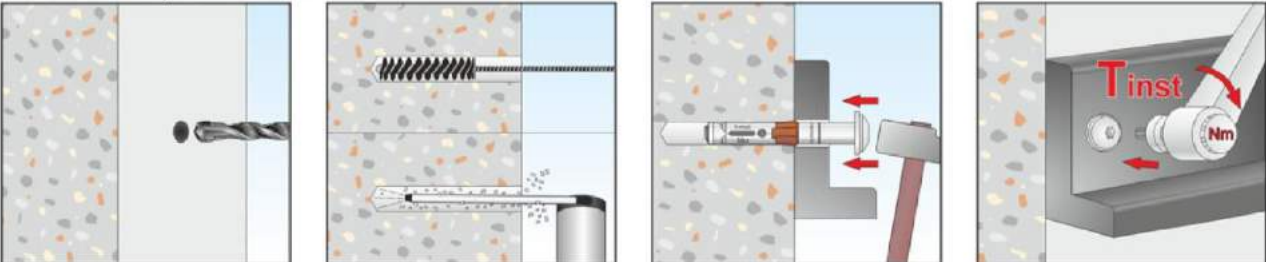
Installation sequence HVE02



Installation sequence HVE03



Installation sequence HVE04



|        |  |
|--------|--|
| Step 1 | Drill a hole into the concrete in rotary plus hammer mode      |
| Step 2 | Remove the dust into the hole using a brush and a blowing pump |
| Step 3 | Place the fixture and hammer the anchor in the drill hole      |
| Step 4 | Apply the required torque moment                               |

**Tecfi HVE Rock**

Intended use  
Installation instructions

**Annex B4**

English translation prepared by DIBt

**Table C1: Performances for design method A (tension)**

| Type of anchor / Size  |                               |        | HVE M6 | HVE M8 | HVE M10 | HVE M12 | HVE M16 |
|--|-------------------------------|--------|--------|--------|---------|---------|---------|
| <b>Steel Failure</b>   |                               |        |        |        |         |         |         |
| Characteristic Resistance  | $N_{Rk,s} = N_{Rk,s,seis,C1}$ | [kN]   | 16     | 29     | 46      | 67      | 125     |
| Partial safety factor  | $\gamma_{Ms}^{1)}$            |        | 1,5    |        |         |         |         |
| <b>Pull-out failure</b>  |                               |        |        |        |         |         |         |
| 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      |
| Characteristic Resistance for seismic performance category C1        | $N_{Rk,p,seis,C1}$            | [kN]   | 5      | 4,2    | 14,4    | 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   |        |         |         |         |
| Installation safety factor   | $\gamma_2 = \gamma_{inst}$    |        | 1,0    |        |         |         |         |
| <b>Concrete cone failure and splitting failure</b>                   |                               |        |        |        |         |         |         |
| 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)  | $s_{eg,sp}$                   | [mm]   | 220    | 320    | 240     | 370     | 390     |
| Edge distance (splitting)  | $c_{cr,sp}$                   | [mm]   | 110    | 160    | 120     | 185     | 195     |
| Factor for uncracked concrete, acc. CEN/TS 1992-4                    | $k_{ucr}$                     |        | 10,1   |        |         |         |         |
| Factor for cracked concrete, acc. CEN/TS 1992-4                      | $k_{cr}$                      |        | 7,2    |        |         |         |         |
| Installation safety factor   | $\gamma_2 = \gamma_{inst}$    |        | 1,0    |        |         |         |         |

<sup>1)</sup> In absence of other national regulations.

**Table C2: Performances for design method A (shear)**

| Type of anchor / Size   |                            |      | HVE M6 | HVE M8 | HVE M10 | HVE M12 | HVE M16 |
|---|----------------------------|------|--------|--------|---------|---------|---------|
| <b>Steel Failure without level arm</b>                        |                            |      |        |        |         |         |         |
| Characteristic Resistance                                     | $V_{Rk,s}$                 | [kN] | 16     | 25     | 43      | 58      | 107     |
| Characteristic Resistance for seismic performance category C1 | $V_{Rk,s,seis,C1}$         | [kN] | 11,4   | 17     | 28      | 43,5    | 55,3    |
| Partial safety factor   | $\gamma_{Ms}^{1)}$         |      | 1,45   |        |         |         |         |
| <b>Steel Failure with level arm</b>                           |                            |      |        |        |         |         |         |
| Characteristic bending moment                                 | $M_{Rk,s}^0$               | [Nm] | 12     | 30     | 60      | 105     | 266     |
| Partial safety factor   | $\gamma_{Ms}^{1)}$         |      | 1,45   |        |         |         |         |
| <b>Concrete pryout failure</b>                                |                            |      |        |        |         |         |         |
| Effective embedment depth                                     | $h_{ef}$                   | [mm] | 55     | 60     | 70      | 90      | 105     |
| Factor for pryout failure                                     | $k = k_3$                  |      | 1      | 2      | 2       | 2       | 2       |
| Installation safety factor                                    | $\gamma_2 = \gamma_{inst}$ |      | 1,0    |        |         |         |         |
| <b>Concrete edge failure</b>                                  |                            |      |        |        |         |         |         |
| Effective anchorage length                                    | $l_{ef}$                   | [mm] | 55     | 60     | 70      | 90      | 105     |
| Effective external diameter anchor                            | $d_{nom}$                  | [mm] | 10     | 12     | 16      | 18      | 24      |
| Installation safety factor                                    | $\gamma_2 = \gamma_{inst}$ |      | 1,0    |        |         |         |         |

<sup>1)</sup> In absence of other national regulations.

**Tecfi HVE Rock**

**Performances**

Characteristic resistance to tension loads under static and quasi-static actions and seismic performance category C1

Annex C

English translation prepared by DIBt

**Table C3: Performances under fire exposure in concrete C20/25 to C50/60 (tension)**

| Duration of fire resistance = 30min, anchor type HVE   |                     |      | M6   | M8  | M10 | M12  | M16  |  |
|--|---------------------|------|--|-----|-----|------|------|--|
| <b>Steel Failure</b>                                   |                     |      |  |     |     |      |      |  |
| Characteristic Resistance                              | $N_{Rk,s,fi,30}$    | [kN] | 0,2  | 0,4 | 0,9 | 1,7  | 3,1  |  |
| <b>Pull-out failure</b>                                |                     |      |  |     |     |      |      |  |
| 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  |  |
| <b>Concrete cone failure</b>                           |                     |      |  |     |     |      |      |  |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,c,fi,30}^0$  | [kN] | 4,0  | 5,0 | 7,4 | 13,8 | 20,3 |  |
| Duration of fire resistance = 60min, anchor type HVE   |                     |      | M6   | M8  | M10 | M12  | M16  |  |
| <b>Steel Failure</b>                                   |                     |      |  |     |     |      |      |  |
| Characteristic Resistance                              | $N_{Rk,s,fi,60}$    | [kN] | 0,2  | 0,3 | 0,8 | 1,3  | 2,4  |  |
| <b>Pull-out failure</b>                                |                     |      |  |     |     |      |      |  |
| 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  |  |
| <b>Concrete cone failure</b>                           |                     |      |  |     |     |      |      |  |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,c,fi,60}^0$  | [kN] | 4,0  | 5,0 | 7,4 | 13,8 | 20,3 |  |
| Duration of fire resistance = 90min, anchor type HVE   |                     |      | M6   | M8  | M10 | M12  | M16  |  |
| <b>Steel Failure</b>                                   |                     |      |  |     |     |      |      |  |
| Characteristic Resistance                              | $N_{Rk,s,fi,90}$    | [kN] | 0,1  | 0,3 | 0,6 | 1,0  | 1,6  |  |
| <b>Pull-out failure</b>                                |                     |      |  |     |     |      |      |  |
| 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  |  |
| <b>Concrete cone failure</b>                           |                     |      |  |     |     |      |      |  |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,c,fi,90}^0$  | [kN] | 4,0  | 5,0 | 7,4 | 13,8 | 20,3 |  |
| Duration of fire resistance = 120min, anchor type HVE  |                     |      | M6   | M8  | M10 | M12  | M16  |  |
| <b>Steel Failure</b>                                   |                     |      |  |     |     |      |      |  |
| Characteristic Resistance                              | $N_{Rk,s,fi,120}$   | [kN] | 0,1  | 0,2 | 0,5 | 0,8  | 1,6  |  |
| <b>Pull-out failure</b>                                |                     |      |  |     |     |      |      |  |
| 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  |  |
| <b>Concrete cone failure</b>                           |                     |      |  |     |     |      |      |  |
| Characteristic Resistance in concrete C20/25 to C50/60 | $N_{Rk,c,fi,120}^0$ | [kN] | 3,2  | 4,0 | 5,9 | 9,0  | 16,3 |  |
| Spacing  | $S_{cr,N}$          | [mm] | $4 \times h_{ef}$  |     |     |      |      |  |
|  | $S_{min}$           |      | 55   | 110 | 80  | 110  |      |  |
| Edge distance  | $C_{cr,N}$          |      | $2 \times h_{ef}$  |     |     |      |      |  |
|  | $C_{min}$           |      | $C_{min} = 2xh_{ef}$ ; If fire attack comes from more than one side, the distance of the anchor has to be $> 300$ mm |     |     |      |      |  |
| Annex C2   |                     |      | Tecfi HVE Rock   |     |     |      |      |  |
| loads under fire exposure                              |                     |      | Performances   |     |     |      |      |  |
|  |                     |      | Characteristic values for tension  |     |     |      |      |  |

**Table C4: Performances under fire exposure in concrete C20/25 to C50/60 (shear)**

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

**Tecfi HVE Rock**

**Performances**

Characteristic values for shear loads under fire exposure

**Annex C3**

**Table C5 : Displacements**

| Tension loads in cracked and uncracked concrete             |                    |      | M6  | M8   | M10  | M12  | 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  |
| Shear loads in cracked and uncracked concrete               |                    |      | M6  | M8   | M10  | M12  | M16  |
| Service shear load in cracked and uncracked concrete C20/25 | V                  | [kN] | 7,7 | 12,3 | 21,0 | 23,3 | 52,5 |
| Displacements   | $\delta_{V0}$      | [mm] | 2,4 | 2,6  | 2,5  | 3,0  | 4,0  |
|   | $\delta_{V\infty}$ | [mm] | 3,6 | 3,9  | 3,8  | 4,5  | 6,0  |

**Tecfi HVE Rock**

Performances  
Displacements

**Annex C4**