# DEKLARACJA WŁAŚCIWOŚCI UŻYTKOWYCH

## DoP 0197

dla kotwa sworzniowa fischer FH II, FH II-I (Kotwy metalowe do stosowania w betonie) PL

1. Niepowtarzalny kod identyfikacyjny typu wyrobu: **DoP 0197**

2. Zamierzone zastosowanie: **Mocowanie w betonie zarysowanym lub niezarysowanym.**
   **Zobacz załącznik, w szczególności aneksy B1- B6**

3. Producent: **fischerwerke GmbH & Co. KG, Klaus-Fischer-Str. 1, 72178 Waldachtal, Niemcy**

4. Upoważniony przedstawiciel: **–**

5. System(-y) oceny i weryfikacji stałości właściwości użytkowych: **1**

6. Europejski dokument oceny: **EAD 330232-00-0601 (Edition 10/ 2016)**
   Europejska ocena techniczna: **ETA-07/0025; 2020-09-23**
   Jednostka ds. oceny technicznej: **DIBt- Deutsches Institut für Bautechnik**
   Jednostka lub jednostki notyfikowane: **1343 MPA Darmstadt / 2873 TU Darmstadt**

7. Deklarowane właściwości użytkowe:

**Wytrzymałość mechaniczna i stabilność osadzenia (BWR 1)**

| | | | |
|---|---|---|---|
| Nośność charakterystyczna na wyrywanie (nośności statyczne i quasi-statyczne): | Nośność do uszkodzenia stali: | Aneksy C1, C2 | $E_S$= 210 000 MPa |
| | Nośność na wyrywanie: | Aneksy C1, C2 | |
| | Nośność do wyrwania stożka betonu: | Aneksy C1, C2 | |
| | Solidność: | Aneksy C1, C2 | |
| | Minimalne odstępy osiowe i krawędziowe: | Aneksy C7 | |
| | Odległość od krawędzi zapobiegająca pękaniu pod obciążeniem: | Aneksy C1, C2 | |
| | Przemieszczenia pod obciążeniem statycznym i quasi-statycznym: | Aneksy C10, C11 | |
| Nośność charakterystyczna na ścinanie (nośności statyczne i quasi-statyczne): | Nośność do uszkodzenia stali (obciążenie ścinające) | Aneksy C3, C4 | |
| | Nośność do uszkodzenia wyważenia: | Aneksy C3, C4 | |
| | Nośność do zniszczenieakrawędzi betonu: | Aneksy C3, C4 | |
| | Przemieszczenia pod obciążeniem statycznym i quasi-statycznym: | Aneksy C10, C11 | |
| | Trwałość: | Aneksy A4, B1 | |
| Nośność charakterystyczna i przemieszczenia w warunkach sejsmicznych dla kategorii C1 i C2: | Nośność do uszkodzenia stali: | Aneksy C8, C9 | |
| | Nośność na wyrywanie: | Aneksy C8, C9 | |
| | Wydłużenie przy zerwaniu: | >8% | |
| | Współczynnik szczeliny pierścieniowej: | Aneksy C8, C9 | |
| | Przemieszczenia: | Aneksy C11 | |

**Ochrona przeciwpożarowa (BWR 2)**

| | | |
|---|---|---|
| Reakcja na ogień: | Klasy (A1) | |
| Odporność na działanie ognia: | Odporność ogniowa do zniszczenia stali (obciążenie | Aneksy C5 |
| | Odporność ogniowa na wyrywanie (obciążenie | Aneksy C5 |
| | Odporność ogniowa na zniszczenie stali (obciążenie | Aneksy C6 |

8. Odpowiednia dokumentacja techniczna lub specjalna dokumentacja techniczna: -

Właściwości użytkowe określonego powyżej wyrobu są zgodne z zestawem deklarowanych właściwości użytkowych. Niniejsza deklaracja właściwości użytkowych wydana zostaje zgodnie z rozporządzeniem (UE) nr 305/2011 na wyłączną odpowiedzialność producenta określonego powyżej.

W imieniu producenta podpisał(-a):

Thilo Pregartner, Dr.-Ing.

Peter Schillinger, Dipl.-Ing.

Tumlingen, 2020-10-06

Niniejsza Deklaracja Właściwości Użytkowych została przygotowana w różnych językach. W razie wątpliwości w interpretacji, wersja angielska jest zawsze miarodajna.

Załącznik zawiera dobrowolne i uzupełniające informacje w języku angielskim (neutralne językowo), a wykraczające poza wymagania prawne.

**Specific Part**

## 1 Technical description of the product

The fischer High-Performance Anchor FH II, FH II-I is an anchor made of galvanised steel (sizes with external diameter 10, 12, 15, 18, 24, 28 and 32, sizes with internal thread 12/M6 I, 12/M8 I, 15/M10 I and 15/M12 I) or stainless steel (sizes with external diameter 10, 12, 15, 18 and 24, sizes with internal thread 12/M6 I, 12/M8 I, 15/M10 I and 15/M12 I) 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 fastener 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 fastener 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 to tension load (static and quasi-static loading) | See Annex C 1, C 2, C 7 |
| Characteristic resistance to shear load (static and quasi-static loading) | See Annex C 3 and C4 |
| Displacements (static and quasi-static loading) | See Annex C 10, C 11 |
| Characteristic resistance and displacements for seismic performance categories C1 and C2 | See Annex C 8, C 9, C 11 |
| Durability | See Annex B 1 |

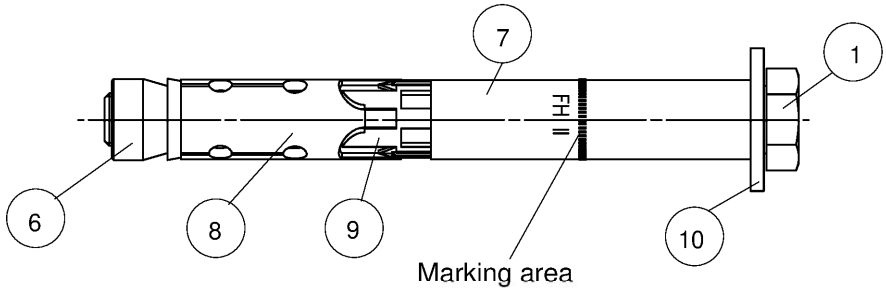
### 3.2 Safety in case of fire (BWR 2)

| Essential characteristic | Performance |
|---|---|
| Reaction to fire | Class A1 |
| Resistance to fire | See Annex C 5, C 6 |

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

In accordance with the European Assessment Document EAD 330232-01-0601 the applicable European legal act is: [96/582/EC].

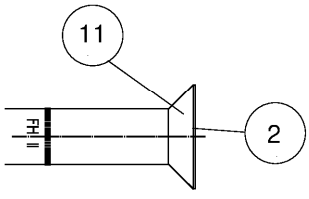
The system to be applied is: 1



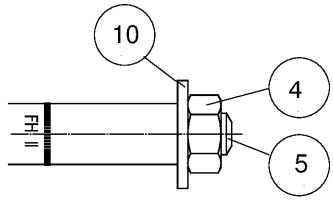

Type hexagon screw **S**
FH II 10 - 32 S
FH II 10 - 24 S R

Product label, example: FH II 15/25 R

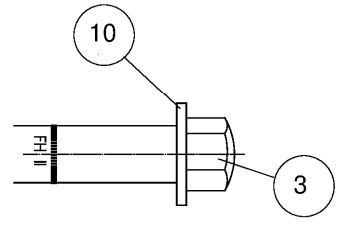
Brand
Type of fastener
Identification R
Nominal drill hole diameter/max. thickness of fixture ($t_{fix}$)




Type countersunk screw **SK**
FH II 10 - 18 SK
FH II 10 - 18 SK R

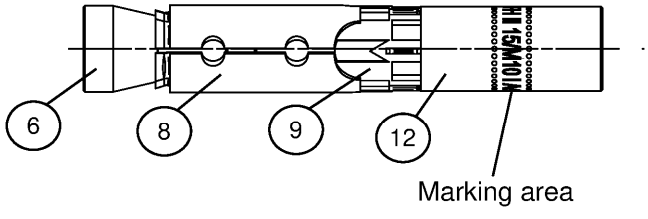



Type hexagon nut **B**
FH II 10 - 32 B
FH II 10 - 24 B R




Type cap nut **H**
FH II 10 - 24 H
FH II 10 - 24 H R

| | |
|---|---|
| 1 | Hexagon screw |
| 2 | Countersunk screw |
| 3 | Cap nut |
| 4 | Hexagon nut |
| 5 | Threaded rod |
| 6 | Cone nut |
| 7 | Distance sleeve |
| 8 | Expansion sleeve |
| 9 | Plastic sleeve |
| 10 | Washer |
| 11 | Conical washer |
| 12 | Internal thread socket |




Type internal threaded anchor I
FH II 12 M6-I or M8-I
FH II 15 M10-I or M12-I

Product label, example: FH II 12/M8-I R

Brand
Type of fastener
Identification R
Nominal drill hole diameter / size of internal thread

*(Fig. not to scale)*

fischer High-Performance Anchor FH II, FH II-I

**Product description**
Anchor types FH II, FH II R, FH II-I, FH II-I R

**Annex A 1**

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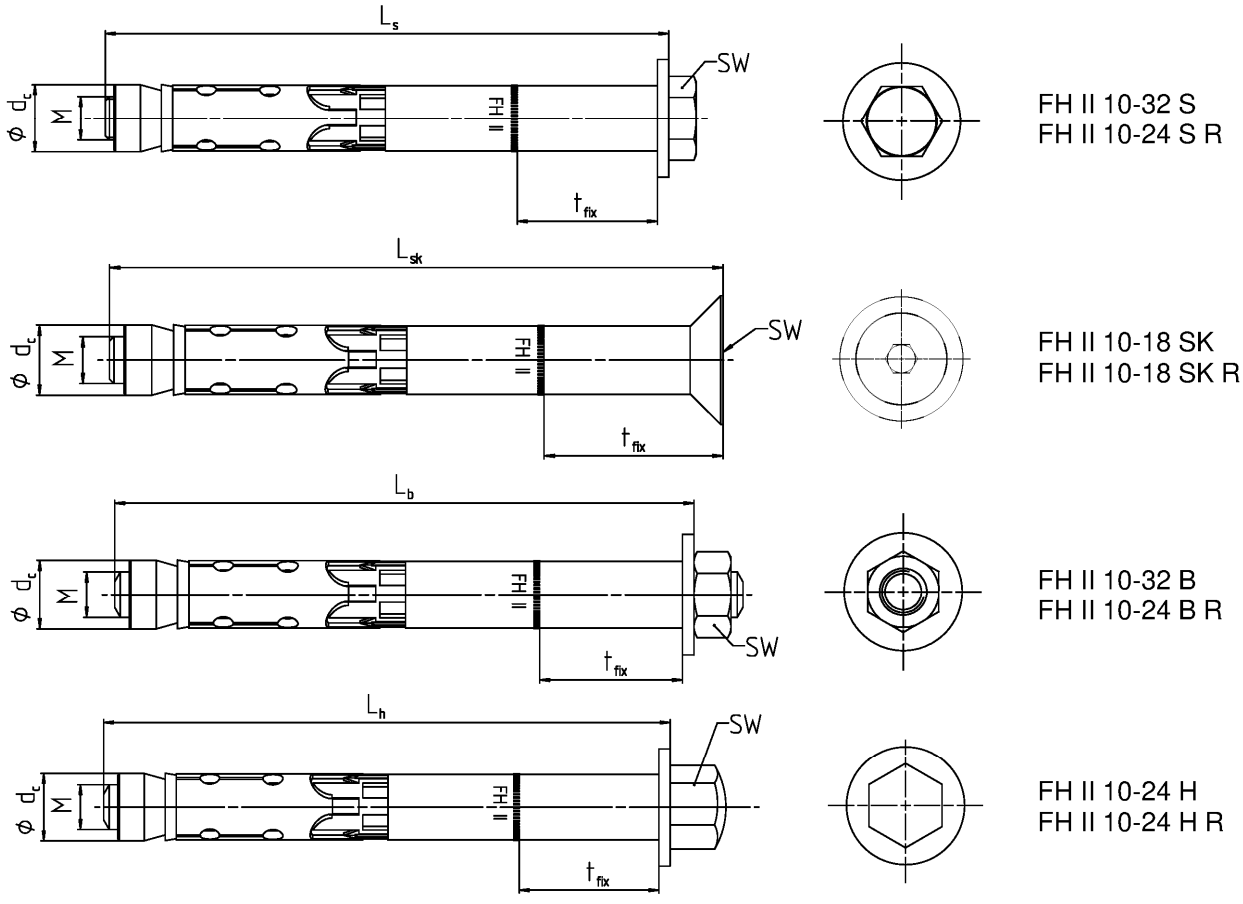



**Table A2.1:** Dimensions [mm] FH II and FH II R

| Anchor type | | | **FH II 10** | **FH II 12** | **FH II 15** | **FH II 18** | **FH II 24** | **FH II 28** | **FH II 32** |
|---|---|---|---|---|---|---|---|---|---|
| Thread | | M | 6 | 8 | 10 | 12 | 16 | 20 | 24 |
| Diameter cone nut | | $d_c$ | 10 | 12 | 14,8 | 17,8 | 23,7 | 27,5 | 31,5 |
| Wrench size SW | FH II-S, -B | | 10 | 13 | 17 | 19 | 24 | 30 | 36 |
| | FH II-SK[1)] | | 4 | 5 | 6 | 8 | [3)] | | |
| | FH II-H | | 13 | 17 | 17 | 19 | 24 | [3)] | |
| | FH II-S R, -B R, -H R | | 10 | 13 | 17 | 19 | 24 | [3)] | |
| | FH II-SK R[1)] | | 4 | 5 | 6 | 8 | [3)] | | |
| $t_{fix}$ FH II-S, -B, -H + FH II-S R, -B R, -H R | | min | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $t_{fix}$ FH II-SK + FH II-SK R [2)] | | min | 5 | 6 | 6 | 8 | [3)] | | |
| Length of screw / bolt | | $L_s$, $L_h$, $L_b$ (- $t_{fix}$) ≥ | 49 | 74 | 89 | 99 | 124 | 149 | 174 |
| Length of countersunk screw | | $L_{sk}$ (- $t_{fix}$) ≥ | 54 | 79 | 95 | 107 | [3)] | | |

[1)] Internal hexagon
[2)] The influence of the thickness of fixture to the characteristic resistance for shear loads, steel failure without lever arm is taken into account, see tables C3.1, C8.1 and C9.1
[3)] Anchor type not part of assessment

*(Fig. not to scale)*

**Table A3.1:** Material FH II and FH II R

| No. | Designation | Material | |
|---|---|---|---|
| | | FH II | FH II R |
| | Steel grade | Steel | Stainless steel R |
| | | Zinc plated ≥ 5 µm, ISO 4042:2018 | Acc. to EN 10088:2014 |
| 1 | Hexagon screw | Steel class 8.8; EN ISO 898-1:2013 | Class 80 EN ISO 3506:2020 |
| 2 | Countersunk screw | | |
| 3 | Cap nut | Steel class 8 | |
| 4 | Hexagon nut | | |
| 5 | Threaded rod | Steel $f_{uk} \geq 800$ N/mm²; $f_{yk} \geq 640$ N/mm² | Stainless steel EN 10088:2014 $f_{uk} \geq 800$ N/mm²;$f_{yk} \geq 640$ N/mm² |
| 6 | Cone nut | Steel EN 10277:2018 | Stainless steel EN 10088:2014 |
| 7 | Distance sleeve | Steel EN 10305:2016 | |
| 8 | Expansion sleeve | Steel EN 10139:2020/ EN 10277:2018 | |
| 9 | Plastic sleeve | ABS (plastic) | |
| 10 | Washer | Steel EN 10139:2020 | Stainless steel EN 10088:2014 |
| 11 | Conical washer | Steel EN 10277:2018 | |

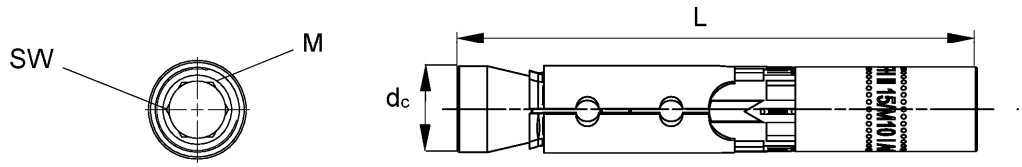



**Table A4.1:** Anchor Dimensions [mm] FH II-I and FH II-I R

| Anchor type FH II-I, FH II-I R | | **FH II 12/M6 I** | **FH II 12/M8 I** | **FH II 15/M10 I** | **FH II 15/M12 I** |
|---|---|---|---|---|---|
| Thread | M | 6 | 8 | 10 | 12 |
| Diameter cone nut | $d_c$ | 12 | 12 | 14,8 | 14,8 |
| Wrench size internal hexagon | SW | 6 | 8 | 6 | 8 |
| Anchor length | L | 77,5 | 77,5 | 90 | 90 |

**Table A4.2:** Material FH II-I and FH II-I R

| No. | Designation | Material | |
|---|---|---|---|
| | | FH II-I | FH II-I R |
| | Steel grade | Steel | Stainless steel R |
| | | Zinc plated ≥ 5 µm, ISO 4042:2018 | Acc. to EN 10088:2014 |
| 6 | Cone nut | Steel EN 10277:2018 | Stainless steel EN 10088:2014 |
| 8 | Expansion sleeve | Steel EN 10139:2020 / EN 10277:2018 | |
| 9 | Plastic sleeve | ABS (plastic) | |
| 12 | Internal thread bolt | Steel EN 10277:2018<br>$f_{uk} \geq 750$ N/mm²,<br>$f_{yk} \geq 600$ N/mm² | Stainless steel EN 10088:2014<br>$f_{uk} \geq 750$ N/mm²,<br>$f_{yk} \geq 600$ N/mm² |
| Requirements for fixing elements | | Steel strength class 5.8, 6.8 or 8.8 EN ISO 898-1:2013 | Steel strength class A50, A70 or A80 EN ISO 3506:2010<br>1.4362, 1.4401, 1.4404, 1.4571, 1.4529 |

*(Fig. not to scale)*

# Specifications of intended use

**Anchorages subject to:**

| Size | | 10 | 12 | 15 | 18 | 24 | 28 | 32 |
|---|---|---|---|---|---|---|---|---|
| High Performance Anchor | FH II-S, -B | | | | ✓ | | | |
| | FH II-H, -S R, -B R, -H R | | | ✓ | | | 1) | |
| | FH II-SK, FH II-SK R | | | ✓ | | 1) | | |
| High Performance Anchor FH II-I, FH II-I R | | 1) | | ✓ | | 1) | | |
| Hammer drilling with standard drill bit  | | | | | | | | |
| Hammer drilling with hollow drill bit with automatic cleaning  | | | | | ✓ | | | |
| Static and quasi-static loads | | | | | | | | |
| Cracked and uncracked concrete | | | | | ✓ | | | |
| Fire exposure | | | | | | | | |
| Seismic performance category | C1 FH II | 2) | | | ✓ | | | |
| | C1 FH II R | | | | ✓ | | 1) | |
| | C2 FH II | | | | ✓ | | | |
| | C2 FH II R | | | | ✓ | | 1) | |
| | C1 FH II-I, FH II-I R | 1) | | 2) | | 1) | | |
| | C2 FH II-I, FH II-I R | | | | | | | |

1) Anchor type not part of the assessment

2) No performance assessed

**Base materials:**

- Compacted reinforced or unreinforced normal weight concrete without fibres (cracked and uncracked) of strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016

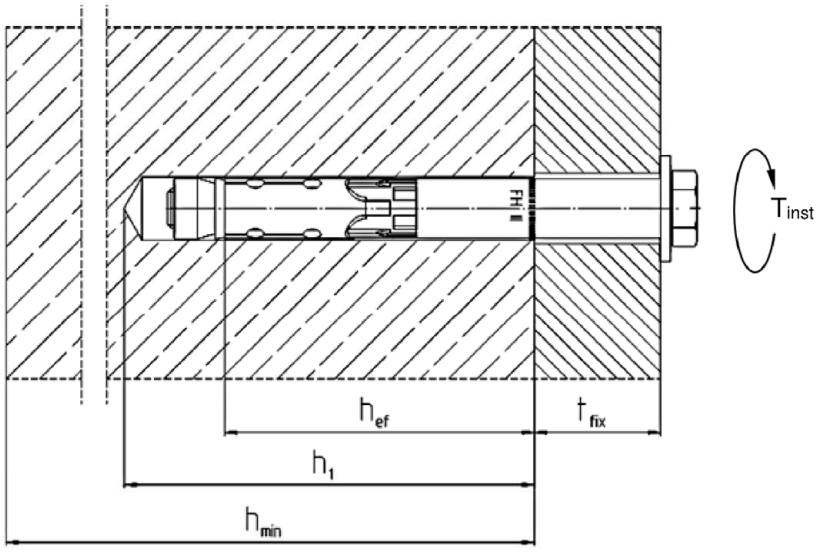
**Use conditions (Environmental conditions):**

- Structures subject to dry internal conditions (FH II, FH II R, FH II-I, FH II-I R)
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal conditions, if no particular aggressive conditions exist (FH II R, FH II-I R)

  Note: 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 deicing materials are used)

**Design:**

- Anchorages are to be designed under the responsibility of an engineer experienced in anchorages and concrete work
- Verifiable calculation notes and drawings are to be 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.)
- Design of fastenings according to EN 1992-4:2018 and EOTA Technical Report TR 055, Edition February 2018




$h_{ef}$ = Effective embedment depth
$t_{fix}$ = Thickness of the fixture
$h_1$ = Depth of drill hole to deepest point
$h_{min}$ = Minimum thickness of concrete member
$T_{inst}$ = Required setting torque

**Table B2.1:** Installation parameters FH II and FH II R

| Anchor type FH II S, -SK, -B, -H and FH II S R, -SK R, -B R, -H R | | | **FH II 10** | **FH II 12** | **FH II 15** | **FH II 18** | **FH II 24** | **FH II 28** | **FH II 32** |
|---|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $d_0$ | [mm] | 10 | 12 | 15 | 18 | 24 | 28 | 32 |
| Maximum diameter of drill bit | $d_{cut} \leq$ | [mm] | 10,45 | 12,50 | 15,50 | 18,50 | 24,55 | 28,55 | 32,70 |
| Depth of drill hole to deepest | $h_1 \geq$ | [mm] | 55 | 80 | 90 | 105 | 125 | 155 | 180 |
| Diameter of clearance hole | $d_f \leq$ | [mm] | 12 | 14 | 17 | 20 | 26 | 31 | 35 |
| Diameter of counter sunk | FH II SK | [mm] | 18 | 22 | 25 | 32 | [1] | | |
| Depth of counter sunk, 90° | FH II SK R | [mm] | 5,0 | 5,8 | 5,8 | 8,0 | | | |
| Required setting torque | FH II S | $T_{inst}$ [Nm] | 10 | 22,5 | 40 | 80 | 160 | 180 | 200 |
| | FH II B | | | 17,5 | 38 | | 120 | 180 | 200 |
| | FH II H | | | 22,5 | 40 | | 90 | [1] | |
| | FH II SK | | | | | | [1] | | |
| | FH II S R, FH II B R FH II H R | | 15 | 25 | 40 | 100 | 160 | [1] | |
| | FH II SK R | | 10 | | | | [1] | | |

[1] Anchor type not part of assessment

*(Fig. not to scale)*

fischer High-Performance Anchor FH II, FH II-I

**Intended use**
Installation parameters FH II, FH II R

**Annex B 2**

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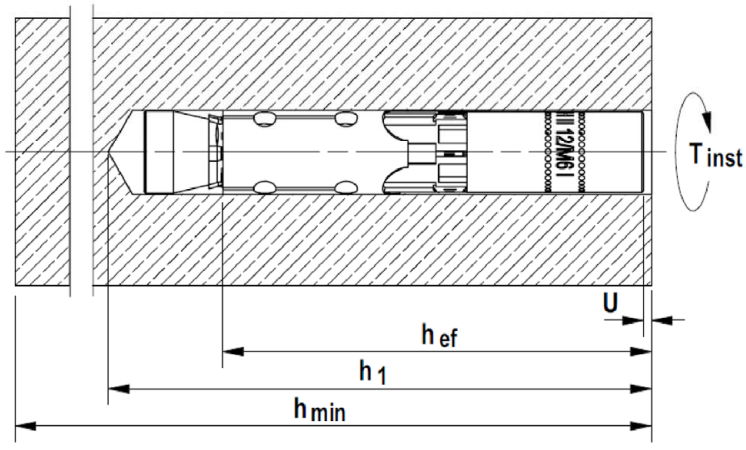
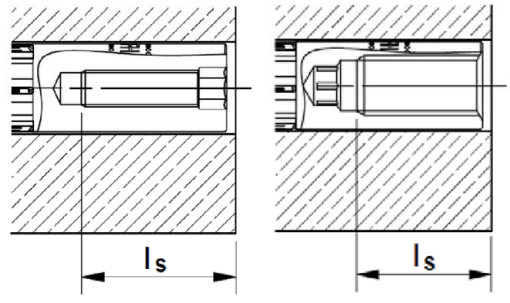



FH II 12/M6 I,
FH II 12/M8 I

FH II 15/M10 I,
FH II 15/M12 I

$h_{ef}$ = Effective embedment depth
$h_1$ = Depth of drill hole to deepest point
$h_{min}$ = Minimum thickness of conrete member
$T_{inst}$ = Required setting torque
U = Required gap after torqueing
$l_s$ = Screw-in depth

**Table B3.1:** Installation parameters FH II-I and FH II-I R

| Anchor type FH II-I and FH II-I R | | | | **FH II 12/M6 I** | **FH II 12/M8 I** | **FH II 15/M10 I** | **FH II 15/M12 I** |
|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $d_0$ | | [mm] | 12 | | 15 | |
| Maximum bit diameter | $d_{cut}$ | ≤ | | 12,50 | | 15,50 | |
| Depth of drill hole | $h_1$ | ≥ | | 85 | | 95 | |
| Diameter of clearance hole | $d_f$ | ≤ | | 7 | 9 | 12 | 14 |
| Required gap after torquing[1)] | U | | | 3 - 5 | | | |
| Required setting torque[1)] | $T_{inst}$ | | [Nm] | 15 | | 25 | |
| Minimum screw-in depth | $l_s$ | ≥ | [mm] | 11 + U | 13 + U | 10 + U | 12 + U |
| Maximum screw-in depth | $l_s$ | ≤ | | 20 + U | | | |
| Maximum torque on fixture in combination with screws and threaded rods strength class ≥ 5.8 resp. ≥ A50 | max $T_{fix}$ | | [Nm] | 3 | 8 | 15 | 20 |

[1)] At least one of the requirements concerning the gap U or the required setting torque $T_{inst}$ have to be fulfilled

*(Fig. not to scale)*

fischer High-Performance Anchor FH II, FH II-I

**Intended use**
Installation parameters FH II-I, FH II-I R

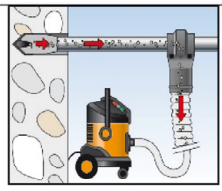
**Annex B 3**

## Installation instructions:

- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Use of the fastener only as supplied by the manufacturer without exchanging the components of the fastener
- Checking before placing the fastener to ensure that the strength class of the concrete in which the fastener 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
- Hammer or hollow drilling according to Annex B5 and B6
- Drill hole created perpendicular +/- 5° to concrete surface, positioning without damaging the reinforcement
- In case of aborted hole: new drilling at a minimum distance twice the depth of the aborted drill 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

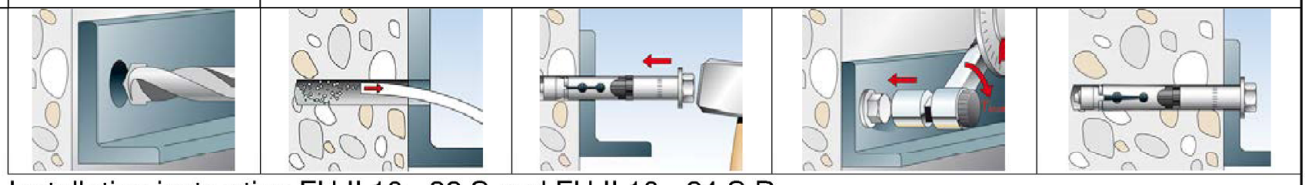
Installation instruction for the fischer High-Performance anchor
**FH II 10 - FH II 32 and FH II 10 R - FH II 24 R**

**Hollow drilling**

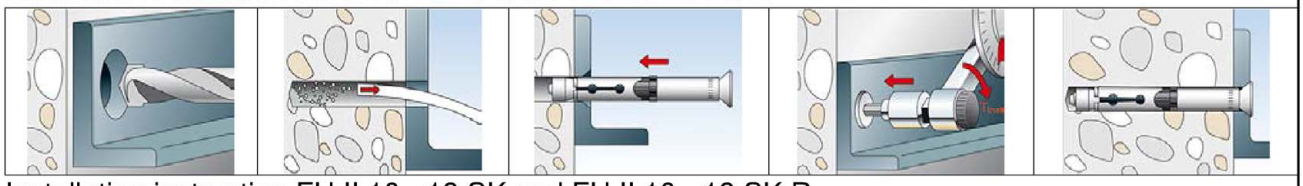


Continue with step 3, 4 and 5

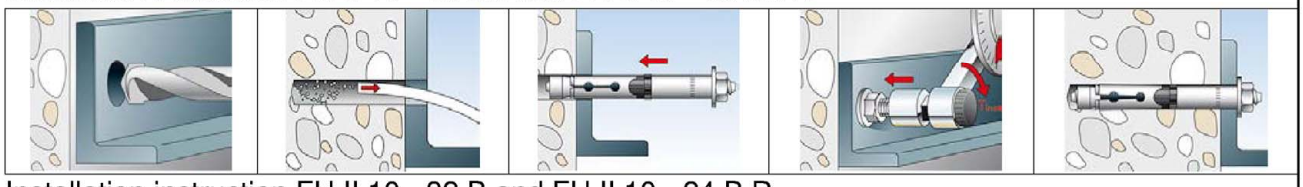
**Hammer drilling**



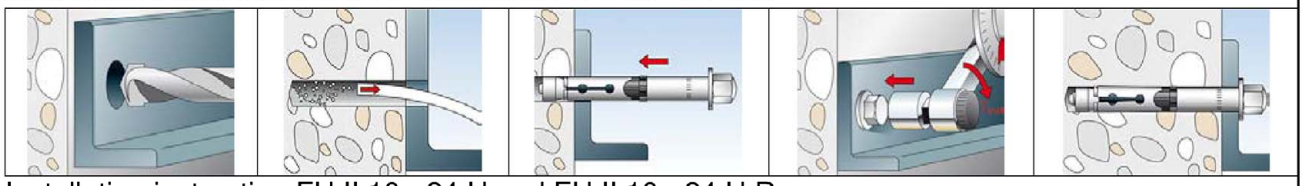
Installation instruction FH II 10 - 32 S and FH II 10 - 24 S R



Installation instruction FH II 10 - 18 SK and FH II 10 - 18 SK R



Installation instruction FH II 10 - 32 B and FH II 10 - 24 B R



Installation instruction FH II 10 - 24 H and FH II 10 - 24 H R

| Step | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|

| Step | Description | |
|---|---|---|
| 1 | Create drill hole with hammer drill | Create drill hole with hollow drill and vacuum cleaner |
| 2 | Clean the hole | - |
| 3 | Set the fastener | |
| 4 | Apply $T_{inst}$ | |
| 5 | Installed fastener | |

Types of drill bits

Hammer drill 

Hollow drill 

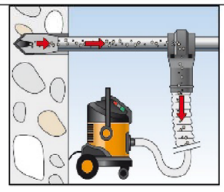
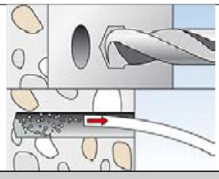
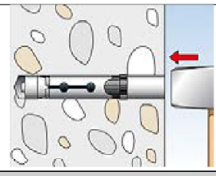
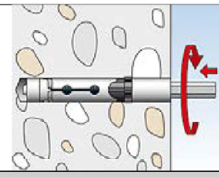
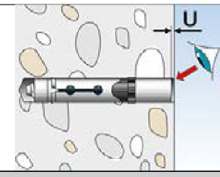
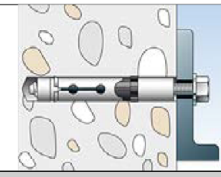
fischer High-Performance Anchor FH II, FH II-I

**Intended use**
Installation instructions FH II, FH II R

**Annex B 5**

Appendix 10/ 22

Installation instruction for the fischer High-Performance anchor internal thread
**FH II-I and FH II-I R**

| | | | | | |
|---|---|---|---|---|---|
| **Hollow drilling** |  | Continue with step 2, 3, and 4 | | | |
| **Hammer drilling** |  |  |  |  |  |
| Step | **1** | **2** | **3** | | **4** |

| Step | Description | |
|---|---|---|
| 1 | Create drill hole with hammer drill, clean drill hole | Create drill hole with hollow drill and vacuum cleaner |
| 2 | Hammering in the anchor flushed with the surface of the concrete | |
| 3 | Tighten the anchor. The included hexagon bit in the package should be used. Other tightening methods are allowed.<br>Tighten the anchor in the concrete until the gap U is 3 - 5 mm or the required setting torque $T_{inst}$ is reached.<br>Only one of the above requirements has to be fulfilled. | |
| 4 | Attach the fixture and use a suitable screw or anchor rod. The length of the screw or anchor rod should be determined depending on the thickness of fixture $t_{fix}$, admissible tolerances, and available thread length $l_{s,max}$ and $l_{s,min}$ including the gap U.<br>Tighten the screw with the torque ≤ max $T_{fix}$ (max $T_{fix}$ see table B3.1) | |

| Types of drill bits | |
|---|---|
| Hammer drill |  |
| Hollow drill |  |

**Table C1.1:** Performance characteristics of **tension resistance** under static and quasi-static loads **for FH II and FH II R**

| Anchor type FH II-S, -SK, -B, -H and FH II-S R, -SK R, -B R, -H R | | | FH II 10 | FH II 12 | FH II 15 | FH II 18 | FH II 24 | FH II 28 | FH II 32 |
|---|---|---|---|---|---|---|---|---|---|
| **Steel failure** | | | | | | | | | |
| FH II-S, -B, | $N_{Rk,s}$ | [kN] | 16,1 | 29,3 | 46,4 | 67,4 | 125,3 | 195,8 | 282,0 |
| FH II-H, FH II-H R, -B R | | | 16,1 | 29,3 | 46,4 | 67,4 | 125,3 | 2) | |
| FH II-SK | | | 16,1 | 29,3 | 46,4 | 67,4 | 2) | | |
| Partial factor | $\gamma_{Ms}$ 1) | [-] | 1,5 | | | | | | |
| FH II-S R | $N_{Rk,s}$ | [kN] | 16,1 | 29,3 | 46,4 | 67,4 | 125,3 | 2) | |
| FH II-SK R | | | 16,1 | 29,3 | 46,4 | 67,4 | 2) | | |
| Partial factor | $\gamma_{Ms}$ 1) | [-] | 1,6 | | | | | | |
| **Pullout failure** | | | | | | | | | |
| Characteristic resistance in cracked concrete C20/25 FH II and FH II R | $N_{Rk,p}$ | [kN] | 7,5 | 12,0 | 16,0 | 25,0 | 34,4 | 48,1 | 63,3 |
| Characteristic resistance in uncracked concrete C20/25 FH II | | | 12,5 | 22,9 | 28,8 | 35,2 | 49,2 | 68,8 | 90,4 |
| Characteristic resistance in uncracked concrete C20/25 FH II R | | | 12,5 | 20,0 | 28,8 | 35,2 | 49,2 | 2) | |
| Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete | $\psi_c$ | C25/30 | 1,12 | | | | | | |
| | | C30/37 | 1,22 | | | | | | |
| | | C35/45 | 1,32 | | | | | | |
| | | C40/50 | 1,41 | | | | | | |
| | | C45/55 | 1,50 | | | | | | |
| | | C50/60 | 1,58 | | | | | | |
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | | |
| **Concrete cone failure and splitting failure** | | | | | | | | | |
| Effective embedment depth | $h_{ef}$ | [mm] | 40 | 60 | 70 | 80 | 100 | 125 | 150 |
| Factor for cracked concrete | $k_{cr,N}$ | [-] | 7,7 3) | | | | | | |
| Factor for uncracked concrete | $k_{ucr,N}$ | | 11,0 3) | | | | | | |
| Spacing | $s_{cr,N}$ | [mm] | 120 | 180 | 210 | 240 | 300 | 375 | 450 |
| Edge distance | $c_{cr,N}$ | | 60 | 90 | 105 | 120 | 150 | 187,5 | 225 |
| Spacing (splitting) | $s_{cr,sp}$ | | 190 | 300 | 320 | 340 | 380 | 480 | 570 |
| Edge distance (splitting) | $c_{cr,sp}$ | | 95 | 150 | 160 | 170 | 190 | 240 | 285 |
| Characteristic resistance (splitting) | $N^0_{Rk,sp}$ | [kN] | min $\{N^0_{Rk,c}; N_{Rk,p}\}$ 4) | | | | | | |

1) In absence of other national regulations
2) Anchor type no performance assessed
3) Based on concrete strength as cylinder strength
4) $N^0_{Rk,c}$ acc. EN 1992-4:2018

**Table C2.1:** Performance characteristics of **tension resistance** under static and quasi-static loads **for FH II-I and FH II-I R**

| Anchor type FH II-I and FH II-I R | | | | **FH II 12/M6 I** | **FH II 12/M8 I** | **FH II 15/M10 I** | **FH II 15/M12 I** |
|---|---|---|---|---|---|---|---|
| **Steel failure** | | | | | | | |
| **Anchor in combination with screw / threaded rod of galvanised steel complying with DIN EN ISO 898** | | | | | | | |
| Strength class 5.8 | $N_{Rk,s}$ | [kN] | | 10 | 19 | 29 | 43 |
| Strength class 6.8 | $N_{Rk,s}$ | [kN] | | 12 | 23 | 35 | 44 |
| Strength class 8.8 | $N_{Rk,s}$ | [kN] | | 16 | 27 | 44 | 44 |
| Partial factor | $\gamma_{Ms}$ [1] | [-] | | 1,5 | | | |
| **Anchor in combination with screw / threaded rod of stainless steel complying with DIN EN ISO 3506** | | | | | | | |
| Screw/thread strength class A50 | $N_{Rk,s}$ | [kN] | | 10 | 19 | 29 | 43 |
| Partial factor | $\gamma_{Ms}$ [1] | [-] | | 2,86 | | | |
| Screw/thread strength class A70 | $N_{Rk,s}$ | [kN] | | 14 | 26 | 41 | 54 |
| Partial factor | $\gamma_{Ms}$ [1] | [-] | | 1,87 | | | |
| Screw/thread strength class A80 | $N_{Rk,s}$ | [kN] | | 16 | 29 | 46 | 46 |
| Partial factor | $\gamma_{Ms}$ [1] | [-] | | 1,60 | | | |
| **Pullout failure** | | | | | | | |
| Characteristic resistance in cracked concrete C20/25 | $N_{Rk,p}$ | [kN] | | 9,0 | | 12,0 | |
| Characteristic resistance in uncracked concrete C20/25 | $N_{Rk,p}$ | [kN] | | 20,0 | | 28,8 | |
| Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete | $\psi_c$ | | C25/30 | 1,12 | | | |
| | | | C30/37 | 1,22 | | | |
| | | | C35/45 | 1,32 | | | |
| | | | C40/50 | 1,41 | | | |
| | | | C45/55 | 1,50 | | | |
| | | | C50/60 | 1,58 | | | |
| Installation factor | $\gamma_{inst}$ | [-] | | 1,0 | | | |
| **Concrete cone failure and splitting failure** | | | | | | | |
| Effective embedment depth | $h_{ef}$ | [mm] | | 60 | | 70 | |
| Factor for cracked concrete | $k_{cr,N}$ | [-] | | 7,7 [2] | | | |
| Factor for uncracked concrete | $k_{ucr,N}$ | [-] | | 11,0 [2] | | | |
| Spacing | $s_{cr,N}$ | [mm] | | 180 | | 210 | |
| Edge distance | $c_{cr,N}$ | [mm] | | 90 | | 105 | |
| Spacing (splitting) | $s_{cr,sp}$ | [mm] | | 300 | | 320 | |
| Edge distance (splitting) | $c_{cr,sp}$ | [mm] | | 150 | | 160 | |
| Characteristic resistance (splitting) | $N^0_{Rk,sp}$ | [kN] | | min $\{N^0_{Rk,c}; N_{Rk,p}\}$ [3] | | | |

[1] In absence of other national regulations
[2] Based on concrete strength as cylinder strength
[3] $N^0_{Rk,c}$ acc. EN 1992-4:2018

**Table C3.1:** Performance characteristics of **shear resistance** for **FH II and FH II R** under static and quasi-static loads

| Anchor type FH II-S, -SK, -B, -H and FH II-S R, -SK R, -B R, -H R | | | FH II 10 | FH II 12 | FH II 15 | FH II 18 | FH II 24 | FH II 28 | FH II 32 |
|---|---|---|---|---|---|---|---|---|---|
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | | |
| **Steel failure without lever arm** | | | | | | | | | |
| FH II-S | $V^0_{Rk,s}$ | [kN] | 18,0 | 33,0 | 59,0 | 76,0 | 146,0 | 176,4 | 217,0 |
| FH II-B | $V^0_{Rk,s}$ | [kN] | 16,0 | 27,2 | 42,8 | 61,9 | 119,0 | 148,8 | 169,0 |
| FH II-H | $V^0_{Rk,s}$ | [kN] | 16,0 | 27,2 | 42,8 | 61,9 | 119,0 | 3) | |
| FH II-SK | $t_{fix}$ 2) | [mm] | ≥ 10 | | ≥ 15 | | 3) | | |
| | $V^0_{Rk,s}$ | [kN] | 18,0 | 33,0 | 59,0 | 76,0 | | | |
| | $t_{fix}$ 2) | [mm] | < 10 | | < 15 | | | | |
| | $V^0_{Rk,s}$ | [kN] | 8,0 | 14,0 | 23,0 | 34,0 | | | |
| Partial factor | $\gamma_{Ms}$ 1) | [-] | 1,25 | | | | | | |
| Factor for ductility | $k_7$ | | 1,0 | | | | | | |
| FH II-S R | $V^0_{Rk,s}$ | [kN] | 18,0 | 33,0 | 59,0 | 76,0 | 146,0 | 3) | |
| Partial factor | $\gamma_{Ms}$ 1) | [-] | 1,33 | | | | | | |
| FH II-B R, -H R | $V^0_{Rk,s}$ | [kN] | 16,0 | 27,2 | 42,8 | 61,9 | 119,0 | 3) | |
| Partial factor | $\gamma_{Ms}$ 1) | [-] | 1,25 | | | | | | |
| FH II-SK R | $t_{fix}$ 2) | [mm] | ≥ 10 | | ≥ 15 | | 3) | | |
| | $V^0_{Rk,s}$ | [kN] | 18,0 | 33,0 | 59,0 | 76,0 | | | |
| | $t_{fix}$ 2) | [mm] | < 10 | | < 15 | | | | |
| | $V^0_{Rk,s}$ | [kN] | 8,0 | 14,0 | 23,0 | 34,0 | | | |
| Partial factor | $\gamma_{Ms}$ 1) | [-] | 1,33 | | | | | | |
| Factor for ductility | $k_7$ | | 1,0 | | | | | | |
| **Steel failure with lever arm and concrete pryout failure** | | | | | | | | | |
| Characteristic bending resistance FH II-S, -SK, -B, -H | $M^0_{Rk,s}$ | [Nm] | 12 | 30 | 60 | 105 | 266 | 518 | 896 |
| Partial factor | $\gamma_{Ms}$ 1) | [-] | 1,25 | | | | | | |
| Characteristic bending resistance FH II R | $M^0_{Rk,s}$ | [Nm] | 12 | 30 | 60 | 105 | 266 | 3) | |
| Partial factor: FH II-B R, -H R | $\gamma_{Ms}$ 1) | [-] | 1,25 | | | | | | |
| Partial factor: FH II-S R, -SK R | $\gamma_{Ms}$ 1) | [-] | 1,33 | | | | | | |
| Factor for pryout failure | $k_8$ | [-] | 1,0 | 2,0 | | | | | |
| **Concrete edge failure** | | | | | | | | | |
| Effective embedment depth for calculation | $l_f$ = | [mm] | $h_{ef}$ | | | | | | |
| Outside diameter of a fastener | $d_{nom}$ | | 10 | 12 | 15 | 18 | 24 | 28 | 32 |

1) In absence of other national regulations
2) The thickness of the fixture has influence to the characteristic resistance for shear loads, steel failure without lever arm
3) No performance assessed

**Table C4.1:** Performance characteristics of **shear resistance** for **FH II-I and FH II-I R** under static and quasi-static loads

| Anchor type FH II-I and FH II-I R | | | **FH II 12/M6 I** | **FH II 12/M8 I** | **FH II 15/M10 I** | **FH II 15/M12 I** |
|---|---|---|---|---|---|---|
| Installation factor | $\gamma_{inst}$ | [-] | 1,0 | | | |
| **Steel failure without lever arm** | | | | | | |
| **Anchor in combination with screw / threaded rod of galvanised steel complying with DIN EN ISO 898:2013** | | | | | | |
| Strength class 5.8 | $V^0_{Rk,s}$ | [kN] | 5 | 9 | 15 | 21 |
| Strength class 6.8 | | | 6 | 11 | 18 | 24 |
| Strength class 8.8 | | | 8 | 14 | 23 | 24 |
| Partial factor | $\gamma_{Ms}$ [1)] | [-] | 1,25 | | | |
| Factor for ductility | $k_7$ | | 1,0 | | | |
| **Anchor in combination with screw / threaded rod of stainless steel complying with DIN EN ISO 3506:2010** | | | | | | |
| Strength class A50 | $V^0_{Rk,s}$ | [kN] | 5 | 9 | 15 | 21 |
| Partial factor | $\gamma_{Ms}$ [1)] | [-] | 2,38 | | | |
| Strength class A70 | $V^0_{Rk,s}$ | [kN] | 7 | 13 | 20 | 30 |
| Partial factor | $\gamma_{Ms}$ [1)] | [-] | 1,56 | | | |
| Strength class A80 | $V^0_{Rk,s}$ | [kN] | 8 | 15 | 23 | 32 |
| Partial factor | $\gamma_{Ms}$ [1)] | [-] | 1,33 | | | |
| Factor for ductility | $k_7$ | | 1,0 | | | |
| **Steel failure with lever arm and concrete pryout failure** | | | | | | |
| **Anchor in combination with screw / threaded rod of galvanised steel complying with DIN EN ISO 898:2013** | | | | | | |
| Strength class 5.8 | $M^0_{Rk,s}$ | [Nm] | 8 | 19 | 37 | 65 |
| Strength class 6.8 | | | 9 | 23 | 44 | 78 |
| Strength class 8.8 | | | 12 | 30 | 60 | 105 |
| Partial factor | $\gamma_{Ms}$ [1)] | [-] | 1,25 | | | |
| Factor for ductility | $k_7$ | | 1,0 | | | |
| **Anchor in combination with screw / threaded rod of stainless steel complying with DIN EN ISO 3506:2010** | | | | | | |
| Strength class A50 | $M^0_{Rk,s}$ | [Nm] | 8 | 19 | 37 | 65 |
| P Partial factor | $\gamma_{Ms}$ [1)] | [-] | 2,38 | | | |
| Strength class A70 | $M^0_{Rk,s}$ | [Nm] | 11 | 26 | 52 | 92 |
| Partial factor | $\gamma_{Ms}$ [1)] | [-] | 1,56 | | | |
| Strength class A80 | $M^0_{Rk,s}$ | [Nm] | 12 | 30 | 60 | 105 |
| Partial factor | $\gamma_{Ms}$ [1)] | [-] | 1,33 | | | |
| Factor for ductility | $k_7$ | | 1,0 | | | |
| Factor for pryout failure | $k_8$ | | 2,0 | | | |
| **Concrete edge failure** | | | | | | |
| Effective embedment depth for calculation | $l_f =$ | [mm] | $h_{ef}$ | | | |
| Outside diameter of fastener | $d_{nom}$ | | 12 | | 15 | |

[1)] In absence of other national regulations

**Table C5.1:** Performance characteristics of **tension resistance** under **fire exposure**

| Anchor type | | R30 | | | R60 | | |
|---|---|---|---|---|---|---|---|
| | | $N_{Rk,s,fi,30}$ [kN] | $N_{Rk,p,fi,30}$ [kN] | $N^0_{Rk,c,fi,30}$ [kN] | $N_{Rk,s,fi,60}$ [kN] | $N_{Rk,p,fi,60}$ [kN] | $N^0_{Rk,c,fi,60}$ [kN] |
| FH II 10, FH II 10 R | | 0,2 | 1,8 | 1,8 | 0,2 | 1,8 | 1,8 |
| FH II 12, FH II 12 R | | 2,0 | 3,0 | 5,0 | 1,3 | 3,0 | 5,0 |
| FH II 15, FH II 15 R | | 3,2 | 4,0 | 7,4 | 2,3 | 4,0 | 7,4 |
| FH II 18, FH II 18 R | | 4,8 | 6,3 | 10,3 | 3,9 | 6,3 | 10,3 |
| FH II 24, FH II 24 R | | 8,9 | 9,0 | 18,0 | 7,3 | 9,0 | 18,0 |
| FH II 28 | | 13,9 | 12,6 | 31,4 | 11,3 | 12,6 | 31,4 |
| FH II 32 | | 20,0 | 16,5 | 49,6 | 16,3 | 16,5 | 49,6 |
| FH II 12/M6-I, | 5.8, A50[1] | 0,1 | 2,3 | 5,0 | 0,1 | 2,3 | 5,0 |
| FH II 12/M6-I R | 8.8, A70, A80[1] [2] | 0,2 | | | 0,2 | | |
| FH II 12/M8-I, | 5.8, A50[1] | 1,3 | | | 0,8 | | |
| FH II 12/M8-I R | 8.8, A70, A80[1] [2] | 2,0 | | | 1,3 | | |
| FH II 15/M10-I, | 5.8, A50[1] | 2,0 | 3,0 | 7,4 | 1,4 | 3,0 | 7,4 |
| FH II 15/M10-I R | 8.8, A70, A80[1] [2] | 3,2 | | | 2,3 | | |
| FH II 15/M12-I, | 5.8/A50[1] | 3,0 | | | 2,4 | | |
| FH II 15/M12-I R | 8.8, A70, A80[1] [2] | 4,8 | | | 3,9 | | |

| Anchor type | | R90 | | | R120 | | |
|---|---|---|---|---|---|---|---|
| | | $N_{Rk,s,fi,90}$ [kN] | $N_{Rk,p,fi,90}$ [kN] | $N^0_{Rk,c,fi,90}$ [kN] | $N_{Rk,s,fi,120}$ [kN] | $N_{Rk,p,fi,120}$ [kN] | $N^0_{Rk,c,fi,120}$ [kN] |
| FH II 10, FH II 10 R | | 0,1 | 1,8 | 1,8 | 0,1 | 1,5 | 1,5 |
| FH II 12, FH II 12 R | | 0,6 | 3,0 | 5,0 | 0,2 | 2,4 | 4,0 |
| FH II 15, FH II 15 R | | 1,4 | 4,0 | 7,4 | 1,0 | 3,2 | 5,9 |
| FH II 18, FH II 18 R | | 3,0 | 6,3 | 10,3 | 2,6 | 5,0 | 8,2 |
| FH II 24, FH II 24 R | | 5,6 | 9,0 | 18,0 | 4,8 | 7,2 | 14,4 |
| FH II 28 | | 8,8 | 12,6 | 31,4 | 7,5 | 10,1 | 25,2 |
| FH II 32 | | 12,6 | 16,5 | 49,6 | 10,8 | 13,2 | 39,7 |
| FH II 12/M6-I, | 5.8, A50[1] | 0,1 | 2,3 | 5,0 | 0,1 | 1,8 | 4,0 |
| FH II 12/M6-I R | 8.8, A70, A80[1] [2] | 0,1 | | | 0,1 | | |
| FH II 12/M8-I, | 5.8, A50[1] | 0,4 | | | 0,1 | | |
| FH II 12/M8-I R | 8.8, A70, A80[1] [2] | 0,6 | | | 0,2 | | |
| FH II 15/M10-I, | 5.8, A50[1] | 0,9 | 3,0 | 7,4 | 0,6 | 2,4 | 5,9 |
| FH II 15/M10-I R | 8.8, A70, A80[1] [2] | 1,4 | | | 1,0 | | |
| FH II 15/M12-I, | 5.8/A50[1] | 1,9 | | | 1,6 | | |
| FH II 15/M12-I R | 8.8, A70, A80[1] [2] | 3,0 | | | 2,6 | | |

[1] Intermediate values by linear interpolation
[2] In combination with screw / threaded rod strength class 8.8, A70, A80

**Table C6.1:** Performance characteristics of **shear resistance** under **fire exposure**

| Anchor type | | R30 | | R60 | |
|---|---|---|---|---|---|
| | | $V_{Rk,s,fi,30}$ [kN] | $M^0_{Rk,s,fi,30}$ [Nm] | $V_{Rk,s,fi,60}$ [kN] | $M^0_{Rk,s,fi,60}$ [Nm] |
| FH II 10, FH II 10 R | | 0,3 | 0 | 0,3 | 0 |
| FH II 12, FH II 12 R | | 2,0 | 2 | 1,3 | 1 |
| FH II 15, FH II 15 R | | 3,2 | 4 | 2,3 | 3 |
| FH II 18, FH II 18 R | | 4,8 | 7 | 3,9 | 6 |
| FH II 24, FH II 24 R | | 8,9 | 19 | 7,3 | 15 |
| FH II 28 | | 13,9 | 37 | 11,3 | 30 |
| FH II 32 | | 20,0 | 64 | 16,3 | 52 |
| FH II 12/M6 I, | 5.8, A50[1] | 0,2 | 0 | 0,2 | 0 |
| FH II 12/M6 I R | 8.8, A70, A80[1) 2)] | 0,3 | 0 | 0,3 | 0 |
| FH II 12/M8 I, | 5.8, A50[1] | 1,3 | 1 | 0,8 | 1 |
| FH II 12/M8-I R | 8.8, A70, A80[1) 2)] | 2,0 | 2 | 1,3 | 1 |
| FH II 15/M10 I, | 5.8, A50[1] | 2,0 | 3 | 1,4 | 2 |
| FH II 15/M10-I R | 8.8, A70, A80[1) 2)] | 3,2 | 4 | 2,3 | 3 |
| FH II 15/M12-I, | 5.8/A50[1] | 3,0 | 4 | 2,4 | 4 |
| FH II 15/M12-I R | 8.8, A70, A80[1) 2)] | 4,8 | 7 | 3,9 | 6 |

| Anchor type | | R90 | | R120 | |
|---|---|---|---|---|---|
| | | $V_{Rk,s,fi,90}$ [kN] | $M^0_{Rk,s,fi,90}$ [Nm] | $V_{Rk,s,fi,120}$ [kN] | $M^0_{Rk,s,fi,120}$ [Nm] |
| FH II 10, FH II 10 R | | 0,2 | 0 | 0,1 | 0 |
| FH II 12, FH II 12 R | | 0,6 | 1 | 0,2 | 0 |
| FH II 15, FH II 15 R | | 1,4 | 2 | 1,0 | 1 |
| FH II 18, FH II 18 R | | 3,0 | 5 | 2,6 | 4 |
| FH II 24, FH II 24 R | | 5,6 | 12 | 4,8 | 10 |
| FH II 28 | | 8,8 | 23 | 7,5 | 20 |
| FH II 32 | | 12,6 | 40 | 10,8 | 34 |
| FH II 12/M6-I, | 5.8, A50[1] | 0,1 | 0 | 0,1 | 0 |
| FH II 12/M6-I R | 8.8, A70, A80[1) 2)] | 0,2 | 0 | 0,1 | 0 |
| FH II 12/M8-I, | 5.8, A50[1] | 0,4 | 1 | 0,1 | 0 |
| FH II 12/M8-I R | 8.8, A70, A80[1) 2)] | 0,6 | 1 | 0,2 | 0 |
| FH II 15/M10 I, | 5.8, A50[1] | 0,9 | 2 | 0,6 | 1 |
| FH II 15/M10-I R | 8.8, A70, A80[1) 2)] | 1,4 | 3 | 1,0 | 1 |
| FH II 15/M12 I, | 5.8/A50[1] | 1,9 | 4 | 1,6 | 3 |
| FH II 15/M12-I R | 8.8, A70, A80[1) 2)] | 3,0 | 6 | 2,6 | 4 |

[1] Intermediate values by linear interpolation
[2] In combination with screw / threaded rod strength class 8.8, A70, A80

**Table C6.2:** Minimum spacings and minimum edge distances of anchors under **fire exposure** for tension and shear loads

| Anchor type | | FH II 10 | FH II 12<br>FH II 12-I | FH II 15<br>FH II 15-I | FH II 18 | FH II 24 | FH II 28 | FH II 32 |
|---|---|---|---|---|---|---|---|---|
| Spacing | $s_{cr,N,fi}$ | 4x $h_{ef}$ | | | | | | |
| | $s_{min,fi}$ | 40 | 50 | 60 | 70 | 80 | 100 | 120 |
| Edge distance | $c_{cr,N,fi}$ [mm] | 2 x $h_{ef}$ | | | | | | |
| | $c_{min,fi}$ | $c_{min,fi}$ = 2 x $h_{ef}$ ,<br>for fire exposure from more than one side $c_{min,fi} \geq$ 300 mm | | | | | | |

fischer High-Performance Anchor FH II, FH II-I

**Perfomances**
Performance characteristics of shear resistance under fire exposure
Minimum spacings and minimum edge distances of anchors under fire exposure

**Annex C 6**

**Table C7.1:** Minimum thickness of concrete member, minimum spacing and minimum edge distances
**FH II, FH II R**

| Anchor type FH II-S, -SK, -B, -H and FH II-S R, -SK R, -B R, -H R | | | **FH II 10** | **FH II 12** | **FH II 15** | **FH II 18** | **FH II 24** | **FH II 28** | **FH II 32** |
|---|---|---|---|---|---|---|---|---|---|
| Minimum thickness of concrete member | $h_{min}$ | [mm] | 80 | 120 | 140 | 160 | 200 | 250 | 300 |
| Minimum spacing, cracked concrete | $s_{min}$ | [mm] | 40 | 50 | 60 | 70 | 80 | 100 | 120 |
| | for c ≥ | | 40 | 80 | 120 | 140 | 180 | 200 | 260 |
| Minimum edge distance, cracked concrete | $c_{min}$ | | 40 | 50 | 60 | 70 | 80 | 100 | 120 |
| | for s ≥ | | 40 | 80 | 120 | 160 | 200 | 220 | 280 |
| Minimum spacing, uncracked concrete | $s_{min}$ | [mm] | 40 | 60 | 70 | 80 | 100 | 120 | 160 |
| | for c ≥ | | 70 | 100 | 100 | 160 | 200 | 220 | 360 |
| Minimum edge distance, uncracked concrete | $c_{min}$ | | 40 | 60 | 70 | 80 | 100 | 120 | 180 |
| | for s ≥ | | 70 | 100 | 140 | 200 | 220 | 240 | 380 |

Intermediate values may be calculated by linear interpolation

**Table C7.2:** Minimum thickness of concrete member, minimum spacing and minimum edge distances
**FH II-I, FH II-I R**

| Anchor type FH II-I and FH II-I R | | | **FH II 12/M6 I FH II 12/M8 I** | **FH II 15/M10 I FH II 15/M12 I** |
|---|---|---|---|---|
| Minimum thickness of concrete member | $h_{min}$ | [mm] | 125 | 150 |
| Minimum spacing, cracked concrete | $s_{min}$ | [mm] | 50 | 60 |
| | for c ≥ | | 80 | 120 |
| Minimum edge distance, cracked concrete | $c_{min}$ | | 50 | 60 |
| | for s ≥ | | 80 | 120 |
| Minimum spacing, uncracked concrete | $s_{min}$ | [mm] | 60 | 70 |
| | for c ≥ | | 100 | 100 |
| Minimum edge distance, uncracked concrete | $c_{min}$ | | 60 | 70 |
| | for s ≥ | | 100 | 140 |

Intermediate values may be calculated by linear interpolation.

**Table C8.1:** Performance characteristics of **tension and shear resistance** for **seismic performance category C1** for FH II-S, -SK, -B, -H and FH II-S R, -SK R, -B R, -H R

| Anchor type FH II-S, -SK, -B, -H and FH II-S R, -SK R, -B R, -H R | | | | **FH II 12** | **FH II 15** | **FH II 18** | **FH II 24** | **FH II 28** | **FH II 32** |
|---|---|---|---|---|---|---|---|---|---|
| **Steel failure** | | | | | | | | | |
| Characteristic resistance of tension load **C1** | FH II-S, -B | $N_{Rk,s,C1}$ | [kN] | 29,3 | 46,4 | 67,4 | 125,3 | 195,8 | 282,0 |
| | FH II-H, -H R, -B R | | | 29,3 | 46,4 | 67,4 | 125,3 | 3) | |
| | FH II-SK | | | 29,3 | 46,4 | 67,4 | 3) | | |
| | Partial factor | $\gamma_{Ms,C1}$ 1) | [-] | 1,5 | | | | | |
| | FH II-S R | $N_{Rk,s,C1}$ | [kN] | 29,3 | 46,4 | 67,4 | 125,3 | 3) | |
| | FH II-SK R | | | 29,3 | 46,4 | 67,4 | 3) | | |
| | Partial factor | $\gamma_{Ms,C1}$ 1) | [-] | 1,6 | | | | | |
| **Pullout failure** | | | | | | | | | |
| Characteristic resistance of tension load in cracked concrete C1 | | $N_{Rk,p,C1}$ | [kN] | 12,0 | 16,0 | 25,0 | 36,0 | 50,3 | 66,1 |
| | | $\gamma_{Mp,C1}$ 1) | [-] | 1,5 | | | | | |
| **Steel failure without lever arm** | | | | | | | | | |
| **Characteristic resistance of shear load C1** | | | | | | | | | |
| FH II-S | | $V_{Rk,s,C1}$ | [kN] | 25,0 | 41,0 | 60,0 | 123,0 | 141,0 | 200,0 |
| FH II-B | | | | 17,0 | 30,0 | 46,0 | 103,0 | 117,0 | 169,0 |
| FH II-H | | | | 17,0 | 30,0 | 46,0 | 103,0 | | |
| FH II-SK | | $t_{fix}$ 2) | [mm] | ≥ 10 | ≥ 15 | | 3) | | |
| | | $V_{Rk,s,C}$ | [kN] | 25,0 | 41,0 | 60,0 | | | |
| | | $t_{fix}$ 2) | [mm] | < 10 | < 15 | | | | |
| | | $V_{Rk,s,C}$ | [kN] | 11,0 | 16,0 | 27,0 | | | |
| Partial factor | | $\gamma_{Ms,C1}$ 1) | [-] | 1,25 | | | | | |
| FH II-S R | | $V_{Rk,s,C1}$ | [kN] | 25,0 | 41,0 | 60,0 | 123,0 | - | |
| Partial factor | | $\gamma_{Ms,C1}$ 1) | [-] | 1,33 | | | | | |
| FH II-B R, -H R | | $V_{Rk,s,C1}$ | [kN] | 17,0 | 30,0 | 46,0 | 103,0 | - | |
| Partial factor | | $\gamma_{Ms,C1}$ 1) | [-] | 1,25 | | | | | |
| FH II-SK R | | $t_{fix}$ 2) | [mm] | ≥ 10 | ≥ 15 | | 3) | | |
| | | $V_{Rk,s,C1}$ | [kN] | 25,0 | 41,0 | 60,0 | | | |
| | | $t_{fix}$ 2) | [mm] | < 10 | < 15 | | | | |
| | | $V_{Rk,s,C1}$ | [kN] | 11,0 | 16,0 | 27,0 | | | |
| Partial factor | | $\gamma_{Ms,C1}$ 1) | [-] | 1,33 | | | | | |
| Factor for annular gap | | $\alpha_{gap}$ | | 0,50 | | | | | |

1) In absence of other national regulations
2) The thickness of the fixture has influence to the characteristic resistance for shear loads, steel failure without lever arm
3) No performance assessed

**Table C9.1:** Performance characteristics of **tension and shear resistance** for **seismic performance category C2** for FH II-S, -SK, -B, -H and FH II-S R, -SK R, -B R, -H R

| Anchor type FH II-S, -SK, -B, -H and FH II-S R, -SK R, -B R, -H R | | | | FH II 12 | FH II 15 | FH II 18 | FH II 24 | FH II 28 | FH II 32 |
|---|---|---|---|---|---|---|---|---|---|
| **Steel failure** | | | | | | | | | |
| Characteristic resistance of tension load **C2** | FH II-S, -B | $N_{Rk,s,C2}$ | [kN] | 29,3 | 46,4 | 67,4 | 125,3 | 195,8 | |
| | FH II-H, -H R, -B R | | | 29,3 | 46,4 | 67,4 | 125,3 | 3) | |
| | FH II-SK | | | 29,3 | 46,4 | 67,4 | 3) | | |
| | Partial factor | $\gamma_{Ms,C2}$ 1) | [-] | 1,5 | | | | | |
| | FH II-S R | $N_{Rk,s,C2}$ | [kN] | 29,3 | 46,4 | 67,4 | 125,3 | 3) | |
| | FH II-SK R | | | 29,3 | 46,4 | 67,4 | 3) | | |
| | Partial factor | $\gamma_{Ms,C2}$ 1) | [-] | 1,6 | | | | | |
| **Pullout failure** | | | | | | | | | |
| Characteristic resistance of tension load in cracked concrete C2 | | $N_{Rk,p,C2}$ | [kN] | 6,2 | 11,3 | 21,8 | 43,0 | 65,9 | |
| | | $\gamma_{Mp,C2}$ 1) | [-] | 1,5 | | | | | |
| **Steel failure without lever arm** | | | | | | | | | |
| **Characteristic resistance of shear load C2** | | | | | | | | | |
| FH II-S | | $V_{Rk,s,C2}$ | [kN] | 14,7 | 28,9 | 41,0 | 100,7 | | |
| FH II-B | | | | 9,8 | 20,9 | 34,1 | 61,9 | 67,2 | |
| FH II-H | | | | 9,8 | 20,9 | 34,1 | 61,9 | 3) | |
| FH II-SK | | $t_{fix}$ 2) | [mm] | ≥ 10 | ≥ 15 | | 3) | | |
| | | $V_{Rk,s,C2}$ | [kN] | 14,8 | 23,3 | 33,8 | | | |
| | | $t_{fix}$ 2) | [mm] | < 10 | < 15 | | | | |
| | | $V_{Rk,s,C2}$ | [kN] | 6,3 | 9,1 | 15,1 | | | |
| Partial factor | | $\gamma_{Ms,C2}$ 1) | [-] | 1,25 | | | | | |
| FH II-S R | | $V_{Rk,s,C2}$ | [kN] | 14,7 | 28,9 | 41,0 | 100,7 | 3) | |
| Partial factor | | $\gamma_{Ms,C2}$ 1) | [-] | 1,33 | | | | | |
| FH II-B R, -H R | | $V_{Rk,s,C2}$ | [kN] | 9,8 | 20,9 | 34,1 | 61,9 | 3) | |
| Partial factor | | $\gamma_{Ms,C2}$ 1) | [-] | 1,25 | | | | | |
| FH II-SK R | | $t_{fix}$ 2) | [mm] | ≥ 10 | ≥ 15 | | 3) | | |
| | | $V_{Rk,s,C2}$ | [kN] | 14,8 | 23,3 | 33,8 | | | |
| | | $t_{fix}$ 2) | [mm] | < 10 | < 15 | | | | |
| | | $V_{Rk,s,C2}$ | [kN] | 6,3 | 9,1 | 15,1 | | | |
| Partial factor | | $\gamma_{Ms,C2}$ 1) | [-] | 1,33 | | | | | |
| Factor for annular gap | | $\alpha_{gap}$ | | 0,50 | | | | | |

1) In absence of other national regulations
2) The thickness of the fixture has influence to the characteristic resistance for shear loads, steel failure without lever arm
3) No performance assessed

**Table C10.1:** Displacements under static and quasi static **tension loads** for FH II and FH II R

| Anchor type FH II-S, -SK, -B, -H and FH II-S R, -SK R, -B R, -H R | | | FH II 10 | FH II 12 | FH II 15 | FH II 18 | FH II 24 | FH II 28 | FH II 32 |
|---|---|---|---|---|---|---|---|---|---|
| Tension load cracked concrete | N | [kN] | 3,6 | 5,7 | 7,6 | 11,9 | 17,1 | 24,0 | 31,5 |
| Corresponding displacements | $\delta_{N0}$ | [mm] | 1,0 | 1,0 | 1,0 | 1,0 | 1,0 | 0,7 | 0,7 |
| | $\delta_{N\infty}$ | | 1,7 | 1,6 | 1,6 | 1,6 | 1,8 | 1,3 | 1,1 |
| Tension load uncracked concrete | N | [kN] | 6,0 | 11,2 | 14,1 | 17,2 | 24,0 | 33,6 | 44,2 |
| Corresponding displacements | $\delta_{N0}$ | [mm] | 0,6 | 1,0 | 1,0 | 1,0 | 1,0 | 0,3 | 0,3 |
| | $\delta_{N\infty}$ | | 1,7 | 1,6 | 1,6 | 1,6 | 1,8 | 1,3 | 1,1 |

**Table C10.2:** Displacements under static and quasi static **tension loads** for FH II-I and FH II-I R

| Anchor type FH II-I and FH II-I R | | | FH II 12/M6 I FH II 12/M8 I | FH II 15/M10 I FH II 15/M12 I |
|---|---|---|---|---|
| Tension load cracked concrete | N | [kN] | 4,3 | 5,7 |
| Tension load uncracked concrete | | | 9,5 | 14,1 |
| Corresponding displacements | $\delta_{N0}$ | [mm] | 1,7 | 1,9 |
| | $\delta_{N\infty}$ | | 2,2 | 2,9 |

**Table C10.3:** Displacements under static and quasi static **shear loads** for FH II-S and FH II-SK

| Anchor type FH II-S and FH II-SK | | | FH II 10 | FH II 12 | FH II 15 | FH II 18 | FH II 24 | FH II 28 | FH II 32 |
|---|---|---|---|---|---|---|---|---|---|
| Shear load in cracked and uncracked concrete | V | [kN] | 10,3 | 18,9 | 33,7 | 43,4 | 83,4 | 99,4 | 124,0 |
| Corresponding displacements | $\delta_{V0}$ | [mm] | 2,4 | 2,7 | 4,4 | 5,0 | 7,0 | 6,0 | 8,0 |
| | $\delta_{V\infty}$ | | 3,6 | 4,1 | 6,6 | 7,5 | 10,5 | 9,0 | 12,0 |

**Table C10.4:** Displacements under static and quasi static **shear loads** for FH II-B and FH II-H

| Anchor type FH II-B and FH II-H | | | FH II 10 | FH II 12 | FH II 15 | FH II 18 | FH II 24 | FH II 28 | FH II 32 |
|---|---|---|---|---|---|---|---|---|---|
| Shear load in cracked and uncracked concrete | V | [kN] | 8,9 | 15,4 | 23,4 | 35,4 | 68,0 | 83,4 | 96,6 |
| Corresponding displacements | $\delta_{V0}$ | [mm] | 2,2 | 2,3 | 3,0 | 5,0 | 7,0 | 5,0 | 5,0 |
| | $\delta_{V\infty}$ | | 3,3 | 3,5 | 4,5 | 7,5 | 10,5 | 7,5 | 7,5 |

**Table C11.1:** Displacements under static and quasi static **shear loads** for FH II-S R, FH II-SK R, FH II-B R and FH II-H R

| Anchor type FH II-S R, -SK R, -B R, -H R | | | **FH II 10** | **FH II 12** | **FH II 15** | **FH II 18** | **FH II 24** |
|---|---|---|---|---|---|---|---|
| Shear load in cracked and uncracked concrete | V | [kN] | 10,3 | 16,0 | 24,6 | 37,7 | 68,0 |
| Corresponding displacements | $\delta_{V0}$ | [mm] | 3,5 | 3,5 | 3,7 | 5,7 | 9,0 |
| | $\delta_{V\infty}$ | | 5,3 | 5,3 | 5,6 | 8,6 | 13,5 |

**Table C11.2:** Displacements under static and quasi static **shear loads** for FH II-I and FH II-I R

| Anchor type: FH II-I and FH II-I R | | | **FH II 12/M6 I** | **FH II 12/M8 I** | **FH II 15/M10 I** | **FH II 15/M12 I** |
|---|---|---|---|---|---|---|
| Shear load in cracked and uncracked concrete | V | [kN] | 4,6 | 8,3 | 13,3 | 13,7 |
| Corresponding displacements | $\delta_{V0}$ | [mm] | 2,6 | 2,6 | 2,2 | 2,2 |
| | $\delta_{V\infty}$ | | 3,9 | 3,9 | 3,3 | 3,3 |

**Table C11.3:** Displacements under **tension loads** for **seismic performance category C2** for FH II and FH II R

| Anchor type FH II-S, -SK, -B, -H and FH II-S R, -SK R, -B R, -H R | | | **FH II 12** | **FH II 15** | **FH II 18** | **FH II 24** | **FH II 28** | **FH II 32** |
|---|---|---|---|---|---|---|---|---|
| Displacement DLS | $\delta_{N,C2\ (DLS)}$ | [mm] | 1,55 | 2,63 | 2,04 | 4,26 | 3,06 | |
| Displacement ULS | $\delta_{N,C2\ (ULS)}$ | | 8,71 | 11,07 | 7,30 | 11,70 | 11,44 | |

**Table C11.4:** Displacements under **shear loads** for **seismic performance category C2** for FH II and FH II R

| Anchor type FH II-S, -SK and FH II-S R, -SK R | | | **FH II 12** | **FH II 15** | **FH II 18** | **FH II 24** | **FH II 28** | **FH II 32** |
|---|---|---|---|---|---|---|---|---|
| Displacement DLS | $\delta_{V,C2\ (DLS)}$ | [mm] | 3,53 | 4,18 | 4,67 | 5,59 | 4,79 | |
| Displacement ULS | $\delta_{V,C2\ (ULS)}$ | | 6,62 | 7,38 | 9,03 | 14,09 | 9,95 | |

| Anchor type FH II-B, -H and FH II-B R, -H R | | | **FH II 12** | **FH II 15** | **FH II 18** | **FH II 24** | **FH II 28** | **FH II 32** |
|---|---|---|---|---|---|---|---|---|
| Displacement DLS | $\delta_{V,C2\ (DLS)}$ | [mm] | 3,42 | 4,26 | 4,29 | 4,79 | | |
| Displacement ULS | $\delta_{V,C2\ (ULS)}$ | | 5,26 | 6,66 | 7,95 | 7,69 | 9,95 | |