# SUORITUSTASOILMOITUS

## DoP 0426

for fischer FAZ II Classic (mekaaninen kiinnitin betoniin)

FI

| | | |
|---|---|---|
| 1. | Tuotetyypin yksilöllinen tunniste: | **DoP 0426** |
| 2. | Aiottu käyttötarkoitus (aiotut käyttötarkoitukset): | **Jälkikäteen tehtäviin kiinnityksiin halkeilevassa tai halkeilemattomassa betonissa, katso lisäys, erityisesti liitteet B1 - B5.** |
| 3. | Valmistaja: | **fischerwerke GmbH & Co. KG, Klaus-Fischer-Str. 1, 72178 Waldachtal, Saksa** |
| 4. | Valtuutettu edustaja: | **–** |
| 5. | Suoritustason pysyvyyden arvioinnissa ja varmentamisessa käytetty järjestelmä/käytetyt järjestelmät: | **1** |
| 6. | Eurooppalainen arviointiasiakirja: | **EAD 330232-02-0601, 2024-09 (Decision (EU) 2025/2355)** |
| | Eurooppalainen tekninen arviointi: | **ETA-23/0162; 2026-10-15** |
| | Teknisestä arvioinnista vastaava laitos: | **ETA-Danmark A/S** |
| | Ilmoitettu laitos/ilmoitetut laitokset: | **2873 TU Darmstadt** |

7. Ilmoitettu suoritustaso/ilmoitetut suoritustasot:

**Mekaaninen lujuus ja vakaus (BWR 1)**

**Tyypillinen kestävyys kuormitukselle (staattinen ja lähes staattinen kuormitus) Menetelmä A:**

1 Teräksen murtokuorma: Liite C1
2 Ulosvetoarvon murtokuorma: Liite C1
3 Betonimassan murtokuorma: Liite C1
4 Kestävyys: Liite C1
5 Pienin reuna- ja keskinäis etäisyys: Liitteet B3, C3
6 Reunaetäisyys halkeamien estämiseksi kuormituksessa: Liite C1

**Tyypillinen kestävyys leikkauskuormalle (staattinen ja näennäisstaattinen kuormitus):**

7 Teräksen murtokuorma (leikkauskuorma): Liite C2
8 Taivutusvoiman murtokuorma: Liite C2

**Ominaisvastus yksinkertaistetulle suunnittelulle:**

9 Menetelmä B: NPD
10 Menetelmä C: NPD

**Siirtymät:**

11 Siirtymät staattisella ja lähes staattisella kuormituksella: Liite C6

**Jäykkyys:**

12 Jäykkyys elastisella alueella vetokuormituksessa: NPD
13 Jäykkyysominaisuudet vetokuormitukselle epälineaarisille jousimalleille: NPD

**Karakteristinen vastus seismisen suorituskyvyn C1-luokassa:**

14 Kestävyys kuormitukselle: Liite C4
15 Leikkauskuorman kestävyys:, Rengasmaisen aukon kerroin: Liite C4

**Ominainen kestävyys ja siirtymät seismisille suoritusluokille C2:**

16 Kestävyys kuormitukselle, siirtymät: Liitteet C5, C6
17 Leikkauskuorman kestävyys, siirtymät, Rengasmaisen aukon kerroin: Liitteet C5, C6

**Paloturvallisuus (BWR 2)**

18 Reagointi tuleen: Class (A1)

**Palonkestävyys:**

19 Palonkestävyys ennen teräksen murtumista (vetokuorma): Liite C7
20 Palonkestävyys ennen ulosvedon murtumista (vetokuorma): Liite C7
21 Palonkestävyys ennen teräksen murtumista (leikkauskuorma): Liite C7

**Kestävyys:**

22 Kestävyys: Liitteet A4, B1

| | | |
|---|---|---|
| 8. | Asianmukainen tekninen asiakirja ja/tai tekninen erityisasiakirja: | **–** |

Edellä yksilöidyn tuotteen suoritustaso on ilmoitettujen suoritustasojen joukon mukainen. Tämä suoritustasoilmoitus on asetuksen (EU) N:o 305/2011 mukaisesti annettu edellä ilmoitetun valmistajan yksinomaisella vastuulla.

Valmistajan puolesta allekirjoittanut:

i.V.

Dr. Christian Weber, Kehitysjohtaja

Dieter Pfaff, Kansainvälisen tuotantoliiton ja laadunhallinnan johtaja

Tumlingen, 2026-11-02

Tämä suoritustasoilmoitus on laadittu useilla kielillä. Jos tulkinnasta syntyy erimielisyyttä, englanninkielinen versio on aina katsottava ensisijaiseksi.
Lisäys sisältää vapaaehtoisesti ilmoitettua ja täydentävää englanninkielistä tietoa, joka ylittää (kielestä riippumatta määritellyt) lakisääteiset vaatimukset.

Translation guidance Essential Characteristics and Performance Parameters for Annexes

**Käännösopas oleellisten piirteiden ja suorituskyvyn parametrien liitteille**

| | | |
|---|---|---|
| Mechanical resistance and stability (BWR 1)<br>**Mekaaninen lujuus ja vakaus (BWR 1)** | | |
| Characteristic resistance under static and quasi-static loading, Method A<br>**Tyypillinen kestävyys kuormitukselle (staattinen ja lähes staattinen kuormitus) Menetelmä A:** | | |
| 1 | Resistance to steel failure:<br>**Teräksen murtokuorma:** | $N_{Rk,s}$ [kN], $E_s$ [N/mm$^2$] |
| 2 | Resistance to pull- out failure:<br>**Ulosvetoarvon murtokuorma:** | $N_{Rk,p}$ [kN], $\psi_c$ |
| 3 | Resistance to concrete cone failure:<br>**Betonimassan murtokuorma:** | $k_{cr,N}$, $k_{ucr,N}$ [-], $h_{ef}$, $c_{cr,N}$ [mm] |
| 4 | Robustness:<br>**Kestävyys:** | $\gamma_{inst}$ [-] |
| 5 | Minimum edge distance and spacing:<br>**Pienin reuna- ja keskinäis etäisyys:** | $c_{min}$, $s_{min}$, $h_{min}$ [mm] |
| 6 | Edge distance to prevent splitting under load:<br>**Reunaetäisyys halkeamien estämiseksi kuormituksessa:** | $N^0_{Rk,sp}$ [kN], $c_{cr,sp}$ [mm] |
| Characteristic resistance to shear load (static and quasi-static loading), Method A<br>**Tyypillinen kestävyys leikkauskuormalle (staattinen ja näennäisstaattinen kuormitus):** | | |
| 7 | Resistance to steel failure under shear load:<br>**Teräksen murtokuorma (leikkauskuorma):** | $V^0_{Rk,s}$ [kN], $M^0_{Rk,s}$ [Nm], $k_7$ [-] |
| 8 | Resistance to pry-out failure:<br>**Taivutusvoiman murtokuorma:** | $k_8$ [-] |
| Characteristic Resistance for simplified design:<br>**Ominaisvastus yksinkertaistetulle suunnittelulle:** | | |
| 9 | Method B:<br>**Menetelmä B:** | $F^0_{Rk}$ [kN], $M^0_{Rk,s}$ [Nm] $\psi_c$ [-], $c_{cr}$, $s_{cr}$, $c_{min}$, $s_{min}$, $h_{min}$ [mm] |
| 10 | Method C:<br>**Menetelmä C:** | $F_{Rk}$ [kN], $M^0_{Rk,s}$ [Nm], $c_{cr}$, $s_{cr}$, $h_{min}$ [mm] |
| Displacements<br>**Siirtymät:** | | |
| 11 | Displacements under static and quasi-static loading:<br>**Siirtymät staattisella ja lähes staattisella kuormituksella:** | $\delta_{N0}$, $\delta N_{50years}$, $\delta N_{100years}$, $\delta_{V0}$, $\delta_{V\infty}$ [mm] |
| 12 | Stiffness characteristics for tension loading for non-linear spring models:<br>**Jäykkyys:** | $k_{1,ucr}$, $k_{2,ucr}$, $k_{3,ucr}$, $k_{4,ucr}$, |
| 12 | Stiffness in the elastic range under tension loading<br>**Jäykkyys elastisella alueella vetokuormituksessa:** | $k_{A,ucr}$, $k_{A,cr}$ [N/mm] |
| 13 | Stiffness characteristics for tension loading for non-linear spring models<br>**Jäykkyysominaisuudet vetokuormitukselle epälineaarisille jousimalleille:** | $k_{A,ucr}$, $k_{B,ucr}$, $k_{C,ucr}$, $k_{D,ucr}$ [N/mm]<br>$k_{A,cr}$, $k_{B,cr}$, $k_{C,cr}$, $k_{D,cr}$ [N/mm] |
| Characteristic resistance for seismic performance category C1:<br>**Karakteristinen vastus seismisen suorituskyvyn C1-luokassa:** | | |
| 14 | Resistance to tension load:<br>**Kestävyys kuormitukselle:** | $N_{Rk,s,C1}$ [kN], $N_{Rk,p,C1}$ [kN] |
| 15 | Resistance to shear load:, Factor annular gap:<br>**Leikkauskuorman kestävyys:, Rengasmaisen aukon kerroin:** | $V_{Rk,s,C1}$ [kN] |
| Characteristic resistance and displacements for seismic performance categorie C2:<br>**Ominainen kestävyys ja siirtymät seismisille suoritusluokille C2:** | | |
| 16 | Resistance to tension load, displacements:<br>**Kestävyys kuormitukselle, siirtymät:** | $N_{Rk,s,C2}$ [kN], $N_{Rk,p,C2}$ [kN]<br>$\delta_{N,C2(0,5)}$, $\delta_{N,C2(0,8)}$ [mm] |
| 17 | Resistance to shear load and displacements, factor annular gap:<br>**Leikkauskuorman kestävyys, siirtymät, Rengasmaisen aukon kerroin:** | $V_{Rk,s,C2}$ [kN],<br>$\delta_{V,C2(0,5)}$, $\delta_{V,C2(0,8)}$ [mm] |
| Safety in case of fire (BWR 2)<br>**Paloturvallisuus (BWR 2)** | | |
| 18 | Reaction to fire:<br>**Reagointi tuleen:** | Class |
| Resistance to fire:<br>**Palonkestävyys:** | | |
| 19 | Fire resistance to steel failure (tension load):<br>**Palonkestävyys ennen teräksen murtumista (vetokuorma):** | $N_{Rk,s,fi}$ [kN] |
| 20 | Fire resistance to pull-out failure (tension load):<br>**Palonkestävyys ennen ulosvedon murtumista (vetokuorma):** | $N_{Rk,p,fi}$ [kN] |
| 21 | Fire resistance to steel failure (shear load):<br>**Palonkestävyys ennen teräksen murtumista (leikkauskuorma):** | $V_{Rk,s,fi}$ [kN], $M^0_{Rk,s,fi}$ [Nm] |
| Aspects of durability<br>**Kestävyys:** | | |
| 22 | Durability:<br>**Kestävyys:** | Class |

# II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

## 1 Technical description of product

fischer FAZ II Classic anchor is a torque-controlled expansion anchor consisting of six sizes: M6, M8, M10, M12, M16 and M20. The fasteners are made of:
Galvanised steel (FAZ II Classic) or
stainless steel (FAZ II Classic R).

The single parts are given in the Figure 1. The materials and dimensions of the anchors are summarised in:
Table A4.1, annex A4 and table A3.1, annex A3, respectively.

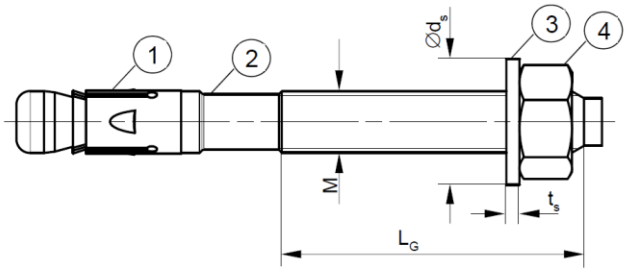



*Figure 1: Technical drawing of the fischer FAZ II Classic anchor.*

The characteristic material values, dimensions and tolerances of the anchors not indicated in Annexes shall correspond to the respective values laid down in the technical documentation of this European Technical Assessment.

## 2 Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD)

The anchors are intended to be used with embedment depth given in Annex B2, Table B2.1. The intended use specifications of the product are detailed in Annex B1.

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annexes.

The provisions made in this European Technical Assessment are based on an assumed intended 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 or Assessment Body 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

| Characteristic | Assessment of characteristic |
|---|---|
| **3.1 Mechanical resistance and stability (BWR 1)** | |
| Resistance to steel failure<br>$N_{Rk,s}$ [kN] | **See annex C1** |
| Resistance to pull-out failure<br>$N_{Rk,p}$[kN]<br>ψc [-] | **See annex C1** |
| Resistance to concrete cone failure<br>$k_{cr,N}$ [-]<br>$k_{ucr,N}$ [-]<br>$h_{ef}$ [mm]<br>$c_{cr,N}$ [mm] | **See annex C1** |
| Robustness<br>$\gamma_{inst}$ [-] | **See annex C1** |
| Mininum edge distance and spacing<br>$c_{min}$ [mm]<br>$s_{min}$ [mm]<br>$h_{min}$ [mm] | **See annexes B3 & C3** |
| Resistance to splitting<br>$N^0_{Rk,sp}$ [kN]<br>$c_{cr,sp}$ [mm] | **See annex C1** |
| Characteristic resistance to shear load (static and quasi-static loading) | |
| Resistance to steel failure under shear load<br>$V^0_{Rk,s}$ [kN]<br>$M^0_{Rk,s}$ [Nm]<br>$k_7$ [-] | **See annex C2** |
| Resistance to pry-out failure<br>$k_8$ [-] | **See annex C2** |
| Displacements | |
| Displacements under static and quasi-static loading<br>$\delta_{N0}$ [mm]<br>$\delta_{\underline{N}}$ [mm]<br>$\delta_{v0}$ [mm]<br>$\delta_{\underline{v}}$ [mm] | **See annex C6** |

| Characteristic | Assessment of characteristic |
|---|---|
| Characteristic resistance and displacements for seismic performance categories C1 and C2 | |
| Resistance to tension load, displacements | |
| C1 | |
| $N_{Rk,s,C1}$ [kN] | **See annex C4** |
| $N_{Rk,p,C1}$ [kN] | |
| C2 | |
| $N_{Rk,s,C2}$ [kN] | **See annex C5 & C6** |
| $N_{Rk,p,C2}$ [kN] | |
| Resistance to shear load, displacements | |
| C1 | **See annex C4** |
| $V_{Rk,s,C1}$ [kN] | |
| C2 | |
| $V_{Rk,s,C2}$ [kN] | **See annex C5 & C6** |
| $\delta_{v,C2}$ [mm] | |
| Factor for annular gap | **See annex C4 & C5** |
| $\alpha_{gap}$ [-] | |
| **3.2 Safety in case of fire (BWR2)** | |
| Fire resistance to steel failure (tension load) | |
| $N_{Rk,sfl}$ [kN] | **See annex C7** |
| Fire resistance to pull-out failure (tension lad) | **See annex C7** |
| $N_{Rk,p,fl}$ [kN] | |
| Fire resistance to steel failure (shear load) | |
| $V_{Rk,s,fl}$ [kN] | **See annex C7** |
| $M^0_{Rk,s,fl}$ [Nm] | |
| **Aspects of durability** | |
| Durability | **No performance assessed** |

See additional information in sections 3.3 and 3.4

### 3.3 Methods of assessment

The assessment of the performance of fischer Bolt Anchor FAZ II Classic in relation to the applicable BWR's has been made in accordance with the European Assessment Document (EAD) No. EAD 330232-02-0601; Mechanical fasteners for use in concrete.

### 3.4 General aspects related to the fitness for use of the product.

The European Technical Assessment is issued for the fischer Bolt Anchor FAZ II Classic based on agreed data/information, deposited with ETA-Danmark, which identifies the product that has been assessed. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to ETA-Danmark before the changes are introduced. ETA-Danmark will decide if such changes affect the ETA and consequently the validity of the CE marking based on the ETA and if so whether further assessment or alterations to the ETA, shall be necessary.

The bolt anchors are manufactured in accordance with the provisions of the European Technical Assessment using the automated manufacturing process as identified during the inspection of the plant by the assessment body issuing the ETA and the notified body and laid down in the technical documentation.

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

### 4.1 AVCP system

According to the decision 1996/582/EC of the European Commission, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No. 305/2011) is 1.

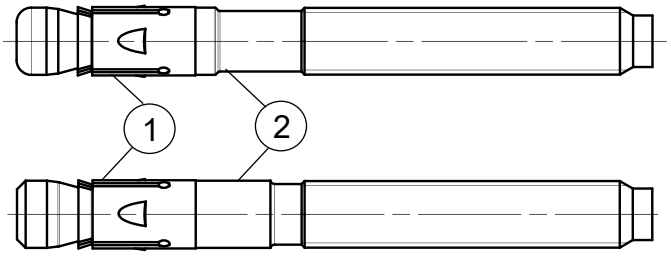
# 5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking.

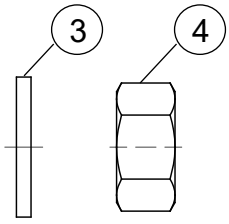
The following standards and documents are referred to in this European Technical Assessment:

- EAD 330232-02-0601: European Assessment Document Mechanical fasteners for use in concrete
- EN 206:2013+A2:2021: Concrete - Specification, performance, production and conformity
- EN ISO 898-2:2022: Fasteners - Mechanical properties of fasteners made of carbon steel and alloy steel - Part 2: Nuts with specified property classes
- EN 1992-4:2018: Eurocode 2 - Design of concrete structures - Part 4: Design of fastenings for use in concrete
- EN 1993-1-4:2025: Eurocode 3 - Design of steel structures - Part 1-4: Stainless steel structure
- EN 10088-1:2023: Stainless steels - Part 1: List of stainless steels
- EN 10139:2016+A1:2020: Cold rolled uncoated low carbon steel narrow strip for cold forming - Technical delivery conditions
- ISO 3506-2:2020: Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 2: Nuts with specified grades and property classes
- ISO 4042:2022: Fasteners - Electroplated coating systems

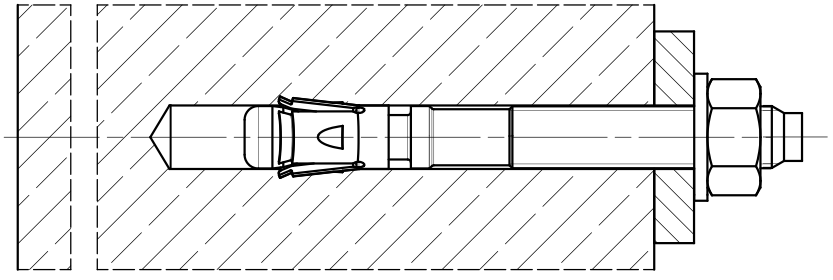
Cone bolt manufactured by cold - forming:




Cone bolt manufactured by turning:

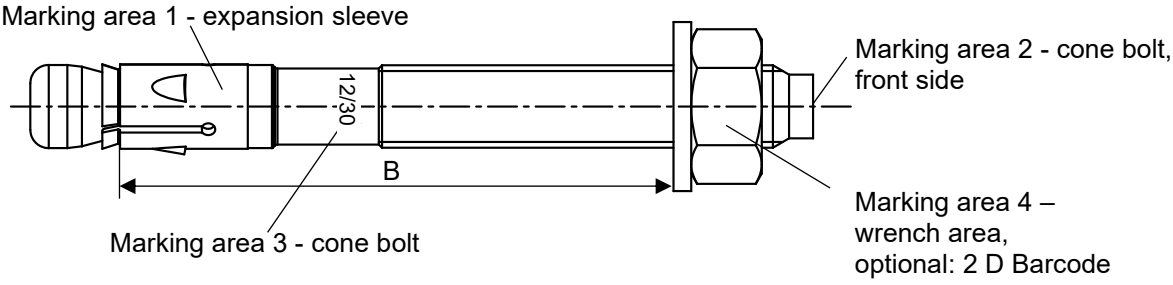



① Expansion sleeve
② Cone bolt (cold – formed or turned)
③ Washer
④ Hexagon nut



*(Figure not to scale)*

## Product marking and letter-code:




Product marking, example: FAZ II Classic 12/30 R

Brand | type of fastener placed at marking area 1 or 3

Thread size / max. thickness of the fixture ($t_{fix}$) identification R placed at marking area 1 or 3

FAZ II Classic: carbon steel, galvanised
FAZ II Classic R: stainless steel

## Table A2.1: Letter - code at marking area 2

| Marking | | (a) | (b) | (c) | (d) | (A) | (B) | (C) | (D) | (E) | (F) | (G) | (H) | (I) | (K) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. $t_{fix}$ [mm] | | 5 | 10 | 15 | 20 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| B ≥ [mm] | M6 | - | | | | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 |
| | M8 | 40 | 45 | - | | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
| | M10 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 |
| | M12 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 |
| | M16 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 |
| | M20 | - | | | | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 |

| Marking | | (L) | (M) | (N) | (O) | (P) | (R) | (S) | (T) | (U) | (V) | (W) | (X) | (Y) | (Z) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. $t_{fix}$ [mm] | | 60 | 70 | 80 | 90 | 100 | 120 | 140 | 160 | 180 | 200 | 250 | 300 | 350 | 400 |
| B ≥ [mm] | M6 | 100 | 110 | 120 | 130 | 140 | 160 | 180 | 200 | 220 | 240 | 290 | 340 | 390 | 440 |
| | M8 | 105 | 115 | 125 | 135 | 145 | 165 | 185 | 205 | 225 | 245 | 295 | 345 | 395 | 445 |
| | M10 | 120 | 130 | 140 | 150 | 160 | 180 | 200 | 220 | 240 | 260 | 310 | 360 | 410 | 460 |
| | M12 | 130 | 140 | 150 | 160 | 170 | 190 | 210 | 230 | 250 | 270 | 320 | 370 | 420 | 470 |
| | M16 | 145 | 155 | 165 | 175 | 185 | 205 | 225 | 245 | 265 | 285 | 335 | 385 | 435 | 485 |
| | M20 | 160 | 170 | 180 | 190 | 200 | 220 | 240 | 260 | 280 | 300 | 350 | 400 | 450 | 500 |

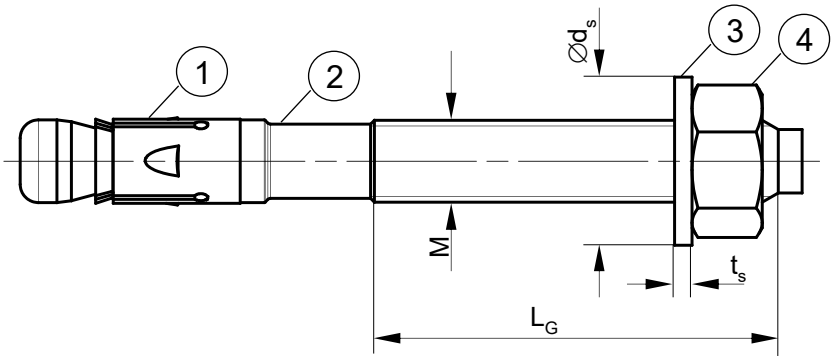
**Calculation existing $h_{ef}$ for installed fasteners:**

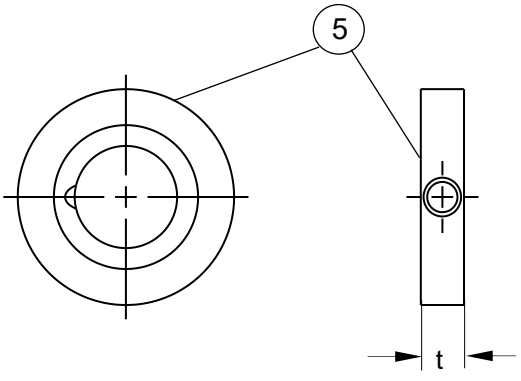
**existing $h_{ef}$ = $B_{(according\ to\ table\ A2.1)}$ – existing $t_{fix}$**

Thickness of the fixture $t_{fix}$ including thickness of filling conical washer t and e.g. thickness of grout layer $t_{grout}$ or other non-structural layers.

*(Figure not to scale)*

## Product dimensions




## Table A3.1: Dimensions [mm]

| Part | Designation | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **M6** | **M8** | **M10** | **M12** | **M16** | **M20** |
| 1 | Expansion sleeve | Sheet thickness | | 0,8 | 1,3 | 1,4 | 1,6 | 2,4 | |
| 2 | Cone bolt | Thread size M | | 6 | 8 | 10 | 12 | 16 | 20 |
| | | $L_G$ | ≥ | 10 | 19 | 26 | 31 | 40 | 50 |
| 3 | Washer | $t_S$ | | 1,4 | | 1,8 | 2,3 | 2,7 | |
| | | ∅ $d_s$ | | 11 | 15 | 19 | 23 | 29 | 36 |
| 4 | Hexagon nut | Wrench size SW | | 10 | 13 | 17 | 19 | 24 | 30 |
| 5 | fischer filling conical washer FFD | t | = | 6 | | | | 7 | 8 |

*(Figure not to scale)*

## Table A4.1: Materials FAZ II Classic

| Part | Designation | Material | |
|---|---|---|---|
| | | **FAZ II Classic** | **FAZ II Classic R** |
| | Steel grade | **Steel** | **Stainless steel R** |
| | | Zinc plated ≥ 5 µm, ISO 4042 | Acc. to EN 10088 Corrosion resistance class CRC III acc. to EN 1993-1-4 |
| 1 | Expansion sleeve | Cold strip, EN 10139 or stainless steel EN 10088 | Stainless steel EN 10088 |
| 2 | Cone bolt | Cold formed steel or free cutting steel | Stainless steel EN 10088 |
| 3 | Washer | Cold strip, EN 10139 | Stainless steel EN 10088 |
| 4 | Hexagon nut | Steel, EN ISO 898-2 | Stainless steel ISO 3506-2 |
| 5 | fischer filling disc FFD | Cold formed steel or free cutting steel | Stainless steel EN 10088 |

## Specifications of intended use

**Fastenings subject to:**

| Size | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|
| | | M6 | M8 | M10 | M12 | M16 | M20 |
| Hammer drilling with standard drill bit  | | ✓ | | | | | |
| Static and quasi-static loads | | ✓ | | | | | |
| Cracked and uncracked concrete | | | | | | | |
| Fire exposure | | | | | | | |
| Seismic performance category | C1 | -[1] | ✓ | | | | |
| | C2 | -[1] | | ✓ | | | |

[1] No performance assessed.

**Base materials:**

- Compacted reinforced and unreinforced normal weight concrete without fibres (cracked or uncracked) according to EN 206.
- Strength classes C12/15 to C50/60 according to EN 206.

**Use conditions (Environmental conditions):**

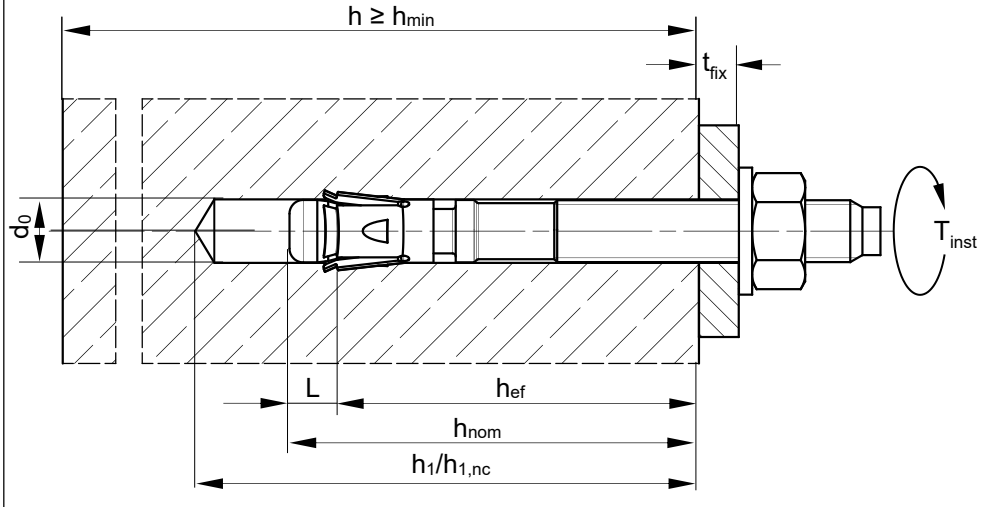
- Structures subject to dry internal conditions (FAZ II Classic, FAZ II Classic R).
- For all other conditions according to EN 1993-1-4 corresponding to corrosion resistance class
  - CRC III: for FAZ II Classic R.

**Design:**

- The structural design is conducted under responsibility of a designer experienced in the field of anchorages and concrete works.
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e.g. position of the fastener relative to reinforcement or to supports, etc.).
- Fastenings in stand-off installation or with a grout layer under seismic action are not covered.
- In case of seismic applications the fastener shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure.
- Design of fastenings according to EN 1992-4.

## Table B2.1: Installation parameters

| Size | | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **M6** | **M8** | **M10** | **M12** | **M16** | **M20** |
| Nominal drill hole diameter | | $d_0$ = | [mm] | 6 | 8 | 10 | 12 | 16 | 20 |
| Effective embedment depth | | $h_{ef} \geq$ | [mm] | 40-80 | 35-90 | 40-100 | 50-125 | 65-160 | 100-180 |
| Length from $h_{ef}$ to end of cone bolt | | L | [mm] | 6,5 | 9,5 | 11,5 | 13,5 | 17,5 | 20 |
| Overall fastener embedment depth in the concrete | | $h_{nom} \geq$ | [mm] | $h_{ef}$ + L | | | | | |
| Depth of drill hole to deepest point | **With** drill hole cleaning | $h_1 \geq$ | [mm] | $h_{nom}$ + 3 | | | $h_{nom}$ + 5 | | $h_{nom}$ + 10 |
| | **Without** drill hole cleaning | $h_{1,nc} \geq$ | [mm] | $h_{nom}$ + 18 | | | $h_{nom}$ + 20 | | $h_{nom}$ + 25 |
| Diameter of clearance hole in the fixture | | $d_f \leq$ | [mm] | 7 | 9 | 12 | 14 | 18 | 22 |
| Required setting torque | | $T_{inst}$ = | [Nm] | 8 | 20 | 45 | 60 | 110 | 200 |




**Legend :**

$d_0$ = Nominal drill hole diameter
$h_{ef}$ = Effective embedment depth
$t_{fix}$ = Thickness of the fixture
$h_1$ = Depth of drill hole to deepest point
$h_{1,nc}$ = Depth of drill hole to deepest point without cleaning (= nc)
h = Thickness of the concrete member
$h_{min}$ = Minimum thickness of concrete member
$h_{nom}$ = Overall fastener embedment depth in the concrete
$T_{inst}$ = Required setting torque
L = Length from $h_{ef}$ to end of cone bolt

*(Figure not to scale)*

## Table B3.1: Minimum thickness of concrete members, minimum spacing and minimum edge distance[1)]

| Size | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | M6 | M8 | M10 | M12 | M16 | M20 |
| **Minimum edge distance** | | | | | | | | |
| Uncracked concrete | $c_{min}$ | [mm] | 40 | 40 | 45 | 55 | 65 | 95 |
| Cracked concrete | $c_{min}$ | [mm] | 40 | 40 | 45 | 55 | 65 | 85 |
| Corresponding spacing | s | [mm] | according to Annex C3 | | | | | |
| Minimum thickness of concrete member | $h_{min}$ | [mm] | 80 | | | 100 | 140 | 160 |
| Thickness of concrete member | h ≥ | [mm] | max. {$h_{min}$; 1,5 · $h_{ef}$; $h_1$[2)] + 25} | | | | max. {$h_{min}$; 1,5 · $h_{ef}$; $h_1$[2)] + 30} | |
| **Minimum spacing** | | | | | | | | |
| Uncracked concrete | $s_{min}$ | [mm] | 35 | 40 | 40 | 50 | 65 | 95 |
| Cracked concrete | $s_{min}$ | [mm] | 35 | 35 | 40 | 50 | 65 | 95 |
| Corresponding edge distance | c | [mm] | according to Annex C3 | | | | | |
| Minimum thickness of concrete member | $h_{min}$ | [mm] | 80 | | | 100 | 140 | 160 |
| Thickness of concrete member | h ≥ | [mm] | max. {$h_{min}$; 1,5 · $h_{ef}$; $h_1$[2)] + 25} | | | | max. {$h_{min}$; 1,5 · $h_{ef}$; $h_1$[2)] + 30} | |
| **Minimum splitting area** | | | | | | | | |
| Uncracked concrete | $A_{sp,req}$ | [·1000 mm²] | 5,1 | 18 | 37 | 54 | 67 | 100 |
| Cracked concrete | $A_{sp,req}$ | [·1000 mm²] | 1,5 | 12 | 27 | 40 | 50 | 77 |

[1)] For cracked and uncracked concrete C12/15 and C16/20: $c_{min} = 1,5 \cdot h_{ef}$ and $s_{min} = 3 \cdot h_{ef}$.

[2)] If borehole cleaning is omitted, $h_1$ is replaced by $h_{1,nc} = h_1 + 15$ mm.

The thickness of the concrete member has to be increased by 15 mm, if drill hole cleaning has not been carried out.

## Table B3.2: Minimum spacing and minimum edge distances - calculated values for for cracked concrete with one edge ($c_2$ and $c_3 \geq 1,5\ c_1$)[1)]

| Size | | FAZ II Classic, FAZ II Classic R | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | M6 | M8 | | M10 | | M12 | | M16 | | M20 |
| Effective anchorage depth | $h_{ef} \geq$ [mm] | 40 | 35 | 45 | 40 | 60 | 50 | 70 | 65 | 85 | 100 |
| Minimum thickness of concrete member | h ≥ [mm] | 80 | | 85 | 80 | 120 | 100 | 140 | 140 | 180 | 160 |
| Minimum spacing | $s_{min}$ [mm] | 35 | | | 40 | | 50 | | 65 | | 95 |
| | for c ≥ [mm] | 40 | | | 100 | 65 | 120 | 80 | 100 | 75 | 130 |
| Minimum edge distance | $c_{min}$ [mm] | 40 | | | 60 | 45 | 70 | 55 | 65 | | 85 |
| | for s ≥ [mm] | 35 | | | 160 | 90 | 190 | 125 | 165 | 85 | 230 |

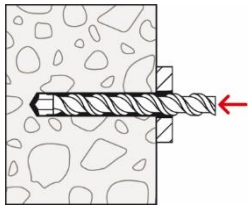
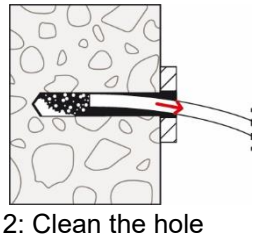
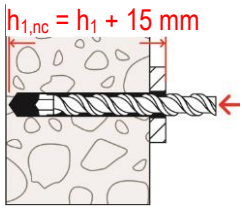
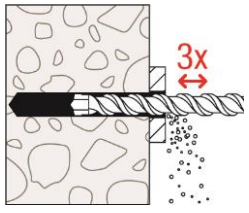
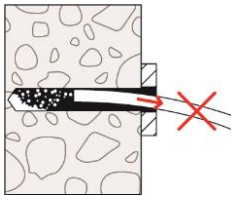
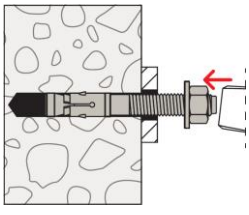
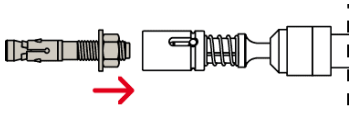
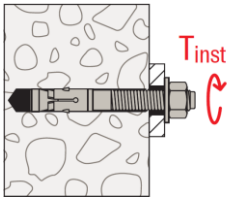
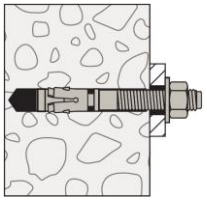
[1)] For cracked and uncracked concrete C12/15 and C16/20: $c_{min} = 1,5 \cdot h_{ef}$ and $s_{min} = 3 \cdot h_{ef}$.

## Installation instructions:

- Fastener installation carried out by appropriately qualified personnel according to the design drawings and under the supervision of the person responsible for technical matters on the site.
- Use of the fastener only as supplied by the manufacturer without exchanging the components of the fastener
- Hammer drilling according to Annex B2.
- Cleaning of the bohrehole can be omitted, if drilling vertically upwards. For horizontal boreholes or those drilled vertically downwards, the drilling depth $h_1$ is increased by 15 mm ($h_{1,nc}$).
- 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.

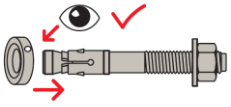
## Installation instructions: Drilling with or without cleaning the hole

**Types of installation**

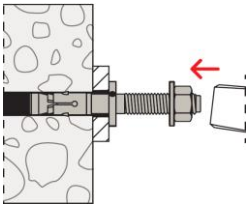
| | | | | |
|---|---|---|---|---|
| Hammer drill (e.g. fischer Quattric II) with cleaning |  |  1: Drill the hole |  2: Clean the hole | Continue with step 5 |
| Hammer drill (e.g. fischer Quattric II) without cleaning | |   1: Drill the hole |   2: When $h_{1,nc}$ is reached: Pull out drill 3 x |  3: Cleaning not necessary Continue with step 5 |
| Setting of the hexagon nut |  5 a: Set the fastener e.g. with a hammer |  5.b: Set the anchor e.g. with FA-ST II |   6: Apply $T_{inst}$ |  7: Installed anchor |

## fischer filling disc optional for e.g. seismic application or minimising the annular gap:

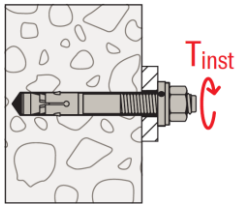
The gap between bolt and fixture may be filled with mortar (compressive strength ≥ 50 N/mm² e.g. fischer FIS SB, fischer FIS EM Plus, fischer FIS V Plus, fischer FIS VL) after last step (for eliminating the annular gap). The FFD can be used in addition to the standard washer. The thickness of the FFD must be considered for definition of $t_{fix}$. Countersunk of the FFD in direction to the anchor plate.



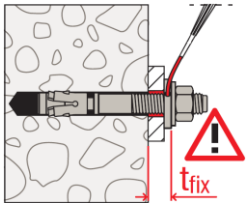
1: Set the fischer filling disc FFD on the bolt



2: Set the fastener e.g. with a hammer




3: Apply $T_{inst}$




4: Fill the annular gap with mortar, e.g. with fischer FIS SB, FIS EM Plus, FIS V Plus, FIS VL

The fischer filling disc FFD is installed after step 3 according to Annex B4.

## Table C1.1: Characteristic values of tension resistance under static and quasi-static action

| Size | | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | M6 | M8 | | M10 | M12 | M16 | M20 |
| **Steel failure** | | | | | | | | | | |
| Characteristic resistance | FAZ II Classic | $N_{Rk,s}$ | [kN] | 11,3 | 17,2 | | 28,3 | 43,4 | 67,1 | 108,4 |
| | FAZ II Classic R | | | 12,0 | 17,6 | | 29,0 | 44,5 | 70,7 | 127,5 |
| Partial factor for steel failure | FAZ II Classic | $\gamma_{Ms}$ [1] | [-] | 1,5 | | | | | | |
| | FAZ II Classic R | | | | | | | | | |
| **Pullout failure** | | | | | | | | | | |
| Effective embedment depth for calculation | | $h_{ef}$ | [mm] | 40-80 | 40 [3] -< 45 | 45-90 | 40-100 | 50-125 | 65-160 | 100-180 |
| Characteristic resistance in cracked concrete C12/15 | | $N_{Rk,p}$ C12/15 | [kN] | - [5] | 3,1 | | 6,2 | 11,4 | 23,6 | 30,9 |
| Characteristic resistance in uncracked concrete C12/15 | | | | - [5] | 7,5 | | 11,6 | 17,1 | 28,2 | 30,9 |
| Increasing factor $\psi_c$ for cracked or uncracked $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C12/15) | | $\psi_c$ C16/20 | [-] | 1,15 | | | | | | |
| Characteristic resistance in cracked concrete C20/25 | | $N_{Rk,p}$ (C20/25) | [kN] | 1,3 | 5,5 | 8,0 | 13,0 | 20,0 | 27,0 | 31,0 |
| Characteristic resistance in uncracked concrete C20/25 | | | | 9,5 | 14,0 | | 20,0 | 22,0 | 38,6 | 42,0 |
| Increasing factor $\psi_c$ for cracked or uncracked concrete $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25) | | | [-] | 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 sensitivity factor | | $\gamma_{inst}$ | [-] | 1,0 | | | | | | |
| **Concrete cone and splitting failure** | | | | | | | | | | |
| Factor for uncracked concrete | | $k_{ucr,N}$ | [-] | 11,0 [2] | | | | | | |
| Factor for cracked concrete | | $k_{cr,N}$ | | 7,7 [2] | | | | | | |
| Characteristic spacing | | $s_{cr,N}$ | [mm] | $3 \cdot h_{ef}$ | | | | | | |
| Characteristic edge distance | | $c_{cr,N}$ | | $1,5 \cdot h_{ef}$ | | | | | | |
| Characteristic spacing for splitting failure | | $s_{cr,sp}$ | [mm] | $2 \cdot c_{cr,sp}$ | | | | | | |
| Characteristic edge distance for splitting failure h | ≥ 80 | $c_{cr,sp}$ [6] | [mm] | 40 | $2,4 \cdot h_{ef}$ | | $2 \cdot h_{ef}$ | | | |
| | ≥ 100 | | | | $2 \cdot h_{ef}$ | | $2,4 \cdot h_{ef}$ | $2 \cdot h_{ef}$ | - [5] | |
| | ≥ 120 | | | | | | $1,9 \cdot h_{ef}$ | $2,1 \cdot h_{ef}$ | | |
| | ≥ 140 | | | | | | | $1,5 \cdot h_{ef}$ | $2 \cdot h_{ef}$ | $2,4 \cdot h_{ef}$ |
| | ≥ 160 | | | | | | | | | |
| | ≥ 200 | | | | | | | | | |
| Characteristic resistance to splitting | | $N^0_{Rk,sp}$ | [kN] | $\min \{N^0_{Rk,c}; N_{Rk,p}\}$ [4] | | | | | | |

[1] In absence of other national regulations.
[2] Based on concrete cylinder strength.
[3] For dry internal exposure and statically indeterminate redundant components, the minimum effective embedment depth can be reduced to 35 mm without reduction of $N_{Rk,p}$.
[4] $N^0_{Rk,c}$ according to EN 1992-4:2018.
[5] No performance assessed.
[6] Increase of $c_{cr,sp}$ by factor 1,75 for concrete C12/15 and C16/20.

## /Table C2.1: Characteristic values of shear resistance under static and quasi-static action

| Size | | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **M6** | **M8** | **M10** | **M12** | **M16** | **M20** |
| **Steel failure without lever arm** | | | | | | | | | |
| Characteristic resistance | FAZ II Classic | $V^0_{Rk,s}$ | [kN] | 6,5 | 13,3 | 21,0 | 31,3 | 55,1 | 70,0 |
| | FAZ II Classic R | | | 7,5 | 14,4 | 19,2 | 38,7 | 64,6 | 80,0 |
| Partial factor for steel failure | | $\gamma_{Ms}$ [1] | [-] | 1,25 | | | | | |
| Factor for ductility | | $k_7$ | | 1,0 | | | | | |
| **Steel failure with lever arm and Concrete pryout failure** | | | | | | | | | |
| Effective embedment depth for calculation | | $h_{ef}$ | [mm] | 40-80 | 45-90 | 60-100 | 70-125 | 85-160 | 100-180 |
| Characteristic bending resistance | FAZ II Classic | $M^0_{Rk,s}$ | [Nm] | 10,0 | 27,0 | 54,0 | 93,0 | 241,0 | 400,0 |
| | FAZ II Classic R | | | | | | | | 500,0 |
| Factor for pryout failure | | $k_8$ | [-] | 2,6 | 2,8 | 3,2 | | | |
| Effective embedment depth for calculation | | $h_{ef}$ | [mm] | -[3] | 40[2]-<45 | 40-<60 | 50-<70 | 65-<85 | -[3] |
| Characteristic bending resistance | FAZ II Classic | $M^0_{Rk,s}$ | [Nm] | | 21,0 | 52,0 | 92,0 | 241,0 | |
| | FAZ II Classic R | | | | | | | | |
| Factor for pryout failure | | $k_8$ | [-] | | 2,5 | 2,6 | 3,1 | 3,2 | |
| Partial factor for steel failure | | $\gamma_{Ms}$ [1] | [-] | 1,25 | | | | | |
| Factor for ductility | | $k_7$ | | 1,0 | | | | | |
| **Concrete edge failure** | | | | | | | | | |
| Effective embedment depth for calculation | | $l_f$ | [mm] | $h_{ef}$ | | | | | |
| Outside diameter of a fastener | | $d_{nom}$ | | 6 | 8 | 10 | 12 | 16 | 20 |

[1] In absence of other national regulations.

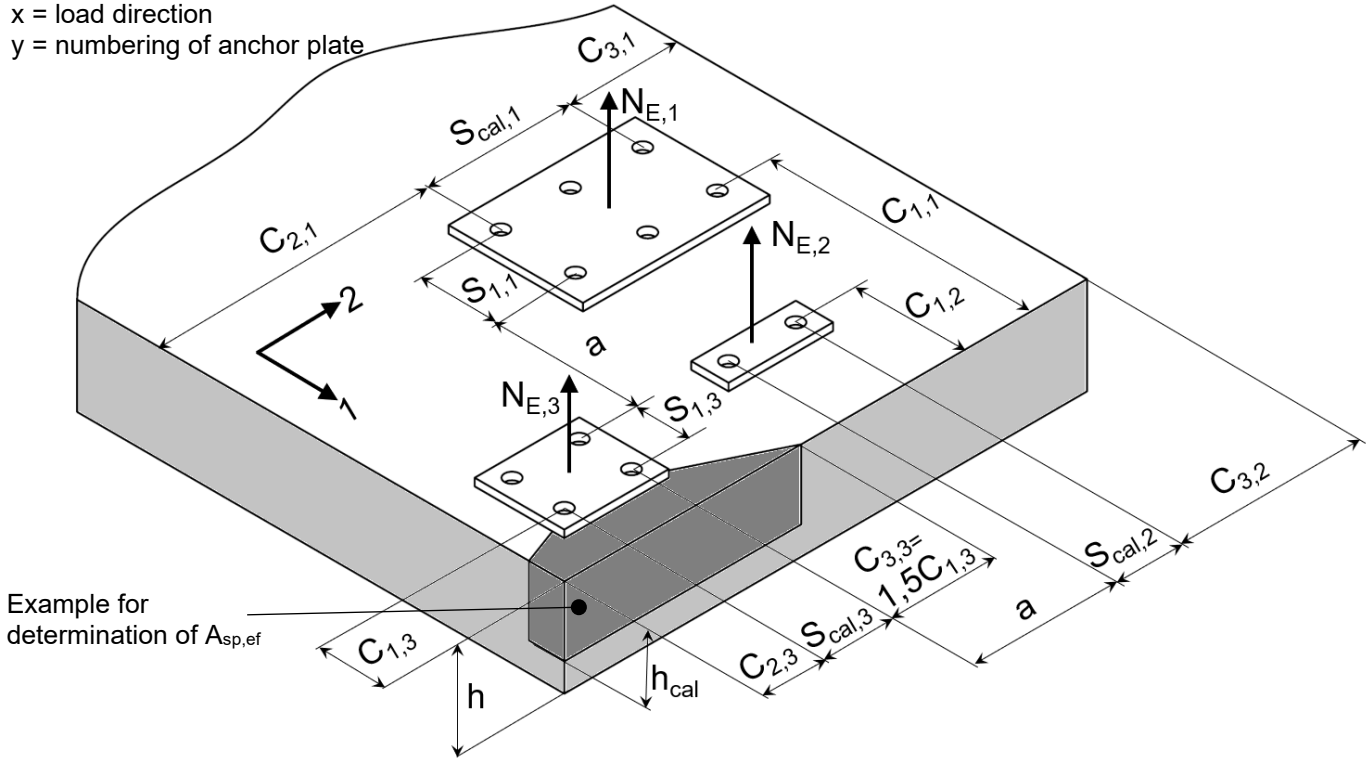
[2] For dry internal exposure and statically indeterminate redundant components, the minimum effective embedment depth can be reduced to 35 mm without reduction of $N_{Rk,p}$.

[3] No performance assessed.

## Determination of $A_{sp,ef}$ for each existing free edge

**Splitting failure** applied for minimum edge distance and spacing in depending on $h_{ef}$

Definition Index:
cal = calculatory
e.g.: $s_{x,y}$
x = load direction
y = numbering of anchor plate




Example for different anchor plates: For considering all free edges the direction 1 and 2 must be swaped.

General formulation for each free edge: $A_{sp,ef} = (c_2 + s_{cal} + c_3) \cdot h_{cal} \geq (n/2) \cdot A_{sp,req}$
with:
Edge distance $c_1$: $c_{min} \leq c_1$
Edge distance $c_2$: $c_{min} \leq c_2 \leq 1{,}5 \cdot c_1$
Edge distance $c_3$: $c_{min} \leq c_3 \leq 1{,}5 \cdot c_1$
Calculation spacing, distance between outer anchors $s_{cal}$: $s_{min} \leq s_{cal} \leq 3{,}0 \cdot c_1$
Distance between group of anchors a: For $a \geq 3{,}0\ c_1$ no influence between the anchor groups is taken into account.
Number of anchors n of an anchor plate as well close and parallel to the edge
Effective member thickness $h_{cal}$: $h_{min} \leq h$; $h_{cal} \leq h$; $h_{cal} \leq (h_{ef} + 1{,}5 \cdot c_1)$
$c_1$, $c_2$, $c_3$, h and $s_{cal}$ have to be set in way that the requirement is fullfiled

For the calculation of minimum spacing and minimum edge distance of fasteners in combination with different embedment depths and thicknesses of concrete members the following equation shall be fulfilled:

$$\mathbf{A_{sp,req} < A_{sp,ef}}$$

$A_{sp,req}$ = required splitting area (according to Annex B3)
$A_{sp,ef}$ = effective splitting area

*(Figure not to scale)*

## Table C4.1: Characteristic values of tension and shear resistance under seismic action category C1

| Size | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **M6** | **M8** | | **M10** | **M12** | **M16** | **M20** |
| Effective embedment depth | $h_{ef}$ | [mm] | -[2)] | 40-<45 | 45-90 | 40-100 | 50-125 | 85-160 | 100-180 |
| With filling of the annular gap | $\alpha_{gap}$ | [-] | 1,0 | | | | | | |
| Without filling of the annular gap | | | 0,5 | | | | | | |
| **Steel failure $N_{Rk,s,C1} = N_{Rk,s}$; $\gamma_{Ms,C1} = \gamma_{Ms}$ (see Annex C1)** | | | | | | | | | |
| | | | | | | | | | |
| **Pullout failure** | | | | | | | | | |
| Characteristic resistance in cracked concrete C1 | $N_{Rk,p,C1}$ | [kN] | -[2)] | 5,1 | 7,4 | 11,6 | 20,0 | 27,0 | 31,5 |
| Installation sensitivity factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | | |
| **Concrete cone failure and splitting failure $N_{Rk,c,C1} = N_{Rk,c}$; $N_{Rk,sp,C1} = N_{Rk,sp}$ (see Annex C1)** | | | | | | | | | |
| | | | | | | | | | |
| **Steel failure without lever arm** | | | | | | | | | |
| Effective embedment depth | $h_{ef}$ | [mm] | -[2)] | 45-90 | | 40-100 | 50-125 | 65-160 | 100-180 |
| Charakteristic resistance C1 Without filling | $V_{Rk,s,C1}$ | [kN] | | 11,0 | | 17,0 | 27,0 | 47,0 | 63,0/78,0[3)] |
| Partial factor for steel failure | $\gamma_{Ms,C1}$[1)] | [-] | 1,25 | | | | | | |

1) In absence of other national regulations.
2) No performance assessed.
3) FAZ II Classic R.

## Table C5.1: Characteristic values of tension and shear resistance under seismic action category C2

| Size | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | M6 | M8 | M10 | M12 | M16 | M20 |
| With filling of the annular gap | $\alpha_{gap}$ | [-] | -[3] | | 1,0 | | | |
| Without filling of the annular gap | | | | | 0,5 | | | |
| **Steel failure $N_{Rk,s,C2} = N_{Rk,s}$; $\gamma_{Ms,C2} = \gamma_{Ms}$ (see Annex C1)** | | | | | | | | |
| **Pullout failure** | | | | | | | | |
| Characteristic resistance tension load in cracked concrete C2 | $h_{ef}$ | [mm] | -[3] | | 60-100 | 70-125 | 85-160 | 100-180 |
| | $N_{Rk,p,C2}$ | [kN] | | | 5,1 | 7,4 | 21,5 | 27,5 |
| | $h_{ef}$ | [mm] | | | 40-<60 | 50-<70 | 65-<85 | -[3] |
| | $N_{Rk,p,C2}$ | [kN] | | | 2,7 | 4,4 | 16,4 | |
| Installation sensitivity factor | $\gamma_{inst}$ | [-] | 1,0 | | | | | |
| **Concrete cone failture and splitting failure $N_{rk,c,C2} = N_{Rk,c}$; $N_{Rk,sp,C2} = N_{Rk,sp}$ (see Annex C1)** | | | | | | | | |

| **Steel failure without lever arm** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | FAZ II Classic, FAZ II Classic R | | | |
| Characteristic resistance C2 | | $h_{ef}$ | [mm] | -[3] | 60-100 | 70-125 | 85-160 | 100-180 |
| | Without filling | $V_{Rk,s,C2}$ | [kN] | | 10,0 | 17,4 | 27,5 | 56,0/63,0[2] |
| | With filling | | | | 13,2 | 19,0 | 35,1 | 61,0/94,0[2] |
| | | $h_{ef}$ | [mm] | | 40-<60 | 50-<70 | 65-<85 | -[3] |
| | Without filling | $V_{Rk,s,C2}$ | [kN] | | 7,0 | 12,7 | 22,0 | |
| | With filling | | | | 9,5 | 19,2 | 23,9 | |
| Partial factor for steel failure | $\gamma_{Ms,C1}$[1] | [-] | 1,25 | | | | | |

[1] In absence of other national regulations.
[2] FAZ II Classic R.
[3] No performance assessed.

## Table C6.1: Displacements under static and quasi static tension loads

| Size | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **M6** | **M8** | **M10** | **M12** | **M16** | **M20** |
| **Displacement – factor for tensile load[1)]** | | | | | | | | |
| $\delta_{N0}$ - factor | in cracked concrete | [mm/kN] | 0,13 | 0,22 | 0,20 | 0,13 | 0,11 | 0,07 |
| $\delta_{N\infty}$ - factor | | | 1,00 | 0,78 | 0,48 | 0,28 | 0,90 | 0,90 |
| $\delta_{N0}$ - factor | in uncracked concrete | | 0,16 | 0,07 | 0,09 | 0,12 | 0,08 | 0,07 |
| $\delta_{N\infty}$ - factor | | | 0,24 | 0,78 | 0,48 | 0,28 | 0,90 | 0,90 |

[1)] Calculation of effective displacement:
$\delta_{N0} = \delta_{N0}$ - factor · N (acting tension load).
$\delta_{N\infty} = \delta_{N\infty}$ - factor · N (acting tension load).

## Table C6.2: Displacements under static and quasi static shear loads

| Size | | | **M6** | **M8** | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|---|---|
| **Displacement – factor for shear load[2)]** | | | | | | | | |
| | | | **FAZ II Classic** | | | | | |
| $\delta_{V0}$ - factor | in cracked or uncracked concrete | [mm/kN] | 0,60 | 0,35 | 0,37 | 0,27 | 0,10 | 0,09 |
| $\delta_{V\infty}$ - factor | | | 0,90 | 0,52 | 0,55 | 0,40 | 0,14 | 0,15 |
| | | | **FAZ II Classic R** | | | | | |
| $\delta_{V0}$ - factor | in cracked or uncracked concrete | [mm/kN] | 0,60 | 0,23 | 0,19 | 0,18 | 0,10 | 0,11 |
| $\delta_{V\infty}$ - factor | | | 0,90 | 0,27 | 0,22 | 0,16 | 0,11 | 0,05 |

[2)] Calculation of effective displacement:
$\delta_{V0} = \delta_{V0}$ - factor · V (acting shear load).
$\delta_{V\infty} = \delta_{V\infty}$ - factor · V (acting shear load).

## Table C6.3: Displacements under tension loads for category C2 for all embedment depths

| Size | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **M6** | **M8** | **M10** | **M12** | **M16** | **M20** |
| Displacement DLS | $\delta_{N,C2(DLS)}$ | [mm] | -[1)] | | 2,7 | 4,4 | 4,4 | 5,6 |
| Displacement ULS | $\delta_{N,C2\ (ULS)}$ | | | | 11,5 | 13,0 | 12,3 | 14,4 |

[1)] No performance assessed.

## Table C6.4: Displacements under shear loads for category C2 for all embedment depths

| Size | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **M6** | **M8** | **M10** | **M12** | **M16** | **M20** |
| Displacement DLS without filling | $\delta_{V,C2\ (DLS)}$ | [mm] | -[1)] | | 4,1 | 4,7 | 5,5 | 4,8 |
| Displacement ULS without filling | $\delta_{V,C2\ (ULS)}$ | | | | 6,2 | 7,8 | 10,1 | 6,3 |
| Displacement DLS with filling | $\delta_{V,C2\ (DLS)}$ | | -[1)] | | 4,1 | 4,7 | 5,5 | 2,0 |
| Displacement ULS with filling | $\delta_{V,C2\ (ULS)}$ | | | | 6,2 | 7,8 | 10,1 | 4,4 |

[1)] No performance assessed.

## Table C7.1: Characteristic values of tension resistance under fire exposure

| Size | | | | FAZ II Classic, FAZ II Classic R | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | M6 | M8 | | M10 | | M12 | | M16 | | M20 |
| | | $h_{ef} \geq$ [mm] | | 40 | 35 | 45 | 40 | 60 | 50 | 70 | 65 | 85 | 100 |
| Characteristic resistance **steel failure** | $N_{Rk,s,fi}$ | R30 | [kN] | 0,6/0,9[1)] | 1,4 | | 2,8 | | 5,0 | | 9,4 | | 14,7 |
| | | R60 | | 0,4/0,9[1)] | 1,2 | | 2,3 | | 4,1 | | 7,7 | | 12,0 |
| | | R90 | | 0,3/0,9[1)] | 0,9 | | 1,9 | | 3,2 | | 6,0 | | 9,4 |
| | | R120 | | 0,2/0,7[1)] | 0,8 | | 1,6 | | 2,8 | | 5,2 | | 8,1 |
| Characteristic resistance **concrete cone failure** | $N_{Rk,c,fi}$ | R30 - R90 | | $7{,}7 \cdot h_{ef}^{1,5} \cdot (20)^{0,5} \cdot h_{ef} / 200 / 1000$ | | | | | | | | | |
| | | R120 | | $7{,}7 \cdot h_{ef}^{1,5} \cdot (20)^{0,5} \cdot h_{ef} / 200 / 1000 \cdot 0{,}8$ | | | | | | | | | |
| Characteristic resistance **pullout failure** | $N_{Rk,p,fi}$ | R30 R60 R90 | | $0{,}25 \cdot N_{Rk,p,cr,C20/25}$ | | | | | | | | | |
| | | R120 | | $0{,}2 \cdot N_{Rk,p,cr,C20/25}$ | | | | | | | | | |

[1)] FAZ II Classic R.

## Table C7.2: Characteristic values of shear resistance under fire exposure

| FAZ II Classic, FAZ II Classic R | | | | 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] |
| M6 | $h_{ef} \geq$ | 40 | [mm] | 0,6/0,9[1)] | 0,5/0,2[1)] | 0,4/0,9[1)] | 0,3/0,1[1)] |
| M8 | | 35 | | 1,8 | 1,4 | 1,6 | 1,2 |
| M10 | | 40 | | 3,6 | 3,6 | 2,9 | 3,0 |
| M12 | | 50 | | 6,3 | 7,8 | 4,9 | 6,4 |
| M16 | | 65 | | 11,7 | 19,9 | 9,1 | 16,3 |
| M20 | | 100 | | 18,2 | 39,0 | 14,2 | 31,8 |

| FAZ II Classic, FAZ II Classic R | | | | 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] |
| M6 | $h_{ef} \geq$ | 40 | [mm] | 0,3/0,9[1)] | 0,2/0,1[1)] | 0,2/0,7[1)] | 0,2/0,1[1)] |
| M8 | | 35 | | 1,3 | 1,0 | 1,2 | 0,8 |
| M10 | | 40 | | 2,2 | 2,4 | 1,9 | 2,1 |
| M12 | | 50 | | 3,5 | 5,0 | 2,8 | 4,3 |
| M16 | | 65 | | 6,6 | 12,6 | 5,3 | 11,0 |
| M20 | | 100 | | 10,3 | 24,6 | 8,3 | 21,4 |

[1)] FAZ II Classic R.

Concrete pryout failure according to EN 1992.

## Table C7.3: Minimum spacings and minimum edge distances of fasteners under fire exposure for tension and shear load

| Size | | | FAZ II Classic, FAZ II Classic R | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | M6 | M8 | M10 | M12 | M16 | M20 |
| Spacing | $s_{min}$ | [mm] | Annex C4 | | | | | |
| Edge distance | $c_{min}$ | | $c_{min} = 2 \cdot h_{ef}$, for fire exposure from more than one side $c_{min} \geq 300$ mm | | | | | |

fischer Bolt Anchor FAZ II Classic, FAZ II Classic R

**Performances**
Characteristic values of resistance under fire exposure

**Annex C7**
Appendix 21 / 21