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Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

MEMBER OF EOTA

# European Technical Assessment ETA-17/0740 of 2025/01/08

I General Part

**Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No. 305/2011:** ETA-Danmark A/S

| | |
|---|---|
| **Trade name of the construction product:** | fischer concrete screw UltraCut FBS II R |
| **Product family to which the above construction product belongs:** | Mechanical fasteners for use in cracked and un-cracked concrete |
| **Manufacturer:** | fischerwerke GmbH & Co. KG<br>Klaus-Fischer-Straße 1<br>D-72178 Waldachtal |
| **Manufacturing plant:** | fischerwerke |
| **This European Technical Assessment contains:** | 16 pages including 11 annexes which form an integral part of the document |
| **This European Technical Assessment is issued in accordance with Regulation (EU) No. 305/2011, on the basis of:** | EAD 330232-01-0601; Mechanical fasteners for use in concrete |
| **This version replaces:** | The ETA with the same number issued on 2022-03-08 |

# II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

## 1 Technical description of product and intended use

**Technical description of the product**
fischer concrete screw UltraCut FBS II R is a concrete screw made of stainless steel. The anchor is installed in a drilled hole and anchored by mechanical interlock.

An illustration of the product is given in Annex A.

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.

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

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

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

The 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

## 3.1 Characteristics of product

**Mechanical resistance and stability (BWR 1):**
The essential characteristics are detailed in the Annex C1, C2 and C4.

**Safety in case of fire (BWR 2):**
The essential characteristics are detailed in the Annex C3.

Durability:
See annex B1.

Other Basic Requirements are not relevant.

## 3.2 Methods of assessment

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Basic Works Requirement 1 has been made in accordance with EAD 330232-01-0601; Mechanical fasteners for use in concrete.

# 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.

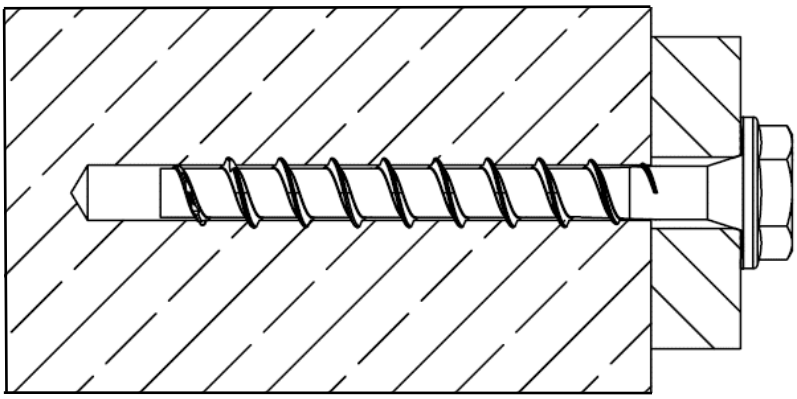
# 5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

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.

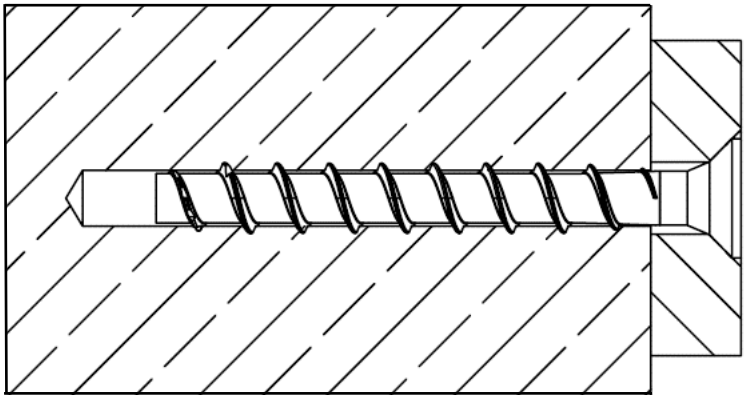
Issued in Copenhagen on 2025-01-08 by

Thomas Bruun
Managing Director, ETA-Danmark

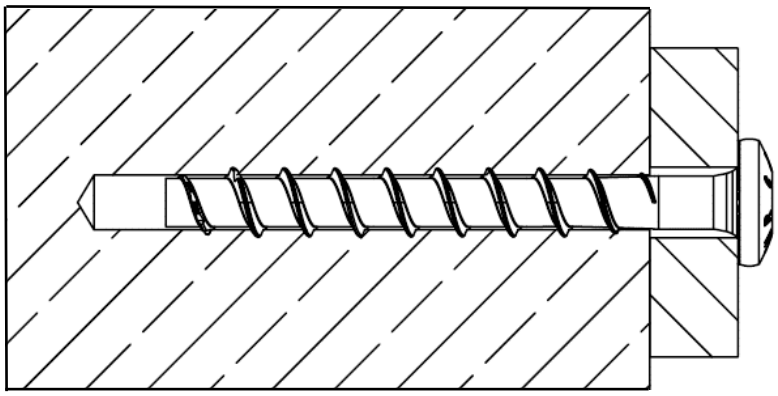
## Product in the installed condition



FBS II US R/
FBS II US TX R



FBS II SK R



FBS II P R

*(Figure not to scale)*

**fischer concrete screw UltraCut FBS II R**

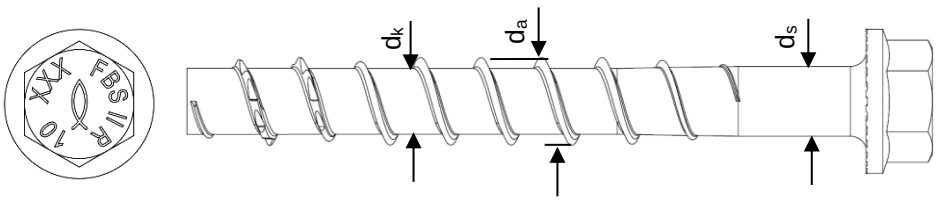
**Annex A 1**

**Product description**
Product in the installed condition

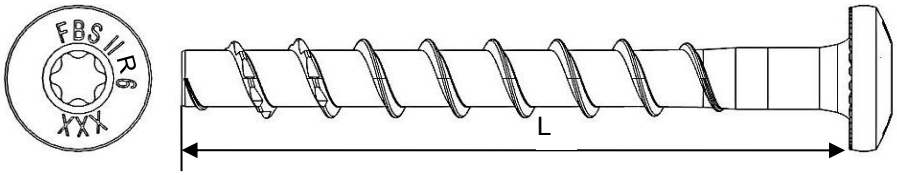
**Table A2.1:** Geometry and material

| Type of screw / size | | | FBS II US R / FBS II SK R / FBS II P R | | | |
|---|---|---|---|---|---|---|
| | | | **6** | **8** | **10** | **12** |
| Thread outer diameter | $d_a$ | [mm] | 7,8 | 10,3 | 12,5 | 14,6 |
| Core diameter | $d_k$ | | 5,6 | 7,5 | 9,4 | 11,1 |
| Shaft diameter | $d_s$ | | 6,0 | 8,0 | 9,9 | 11,7 |
| Material | | | Tip: hardened steel;<br>Shaft and head: stainless steel EN 10088-1:2023 | | | |
| Coating | | | Tip: red colour | | | |

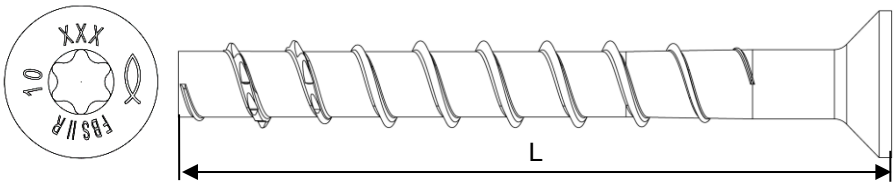
Hexagon head with formed washer **(US/US TX)**



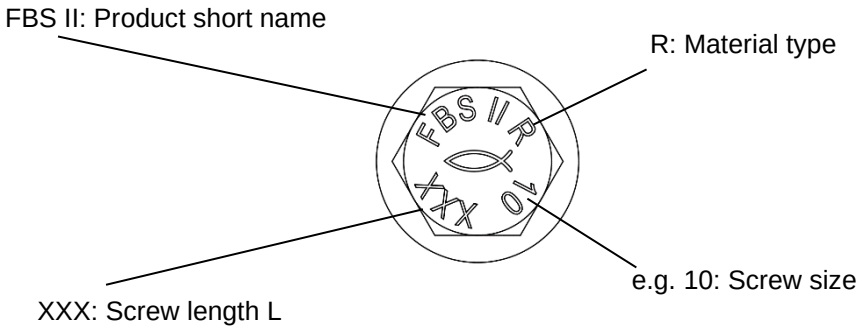

Pan head **(P)**




Countersunk Head **(SK)**




## Head Marking (example)




*(Figure not to scale)*

**fischer concrete screw UltraCut FBS II R**

**Annex A 2**

**Product description**
Geometry and material

## Specification of intended use:

| Size | FBS II R | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 6 | 8 | | 10 | | | 12 | | |
| Nominal embedment depth [mm] | 60 | 50 | 65 | 55 | 65 | 85 | 60 | 75 | 100 |
| Hammer drilling  | ✓ | | | | | | | | |
| Hollow drilling  | - [1] | ✓ | | | | | | | |
| Diamond drilling  | | | | | | | | | |
| Static and quasi-static loads | ✓ | | | | | | | | |
| Cracked and uncracked concrete | | | | | | | | | |
| Fire exposure | | | | | | | | | |
| Seismic performance category C1 | ✓ | - [1] | ✓ | - [1] | ✓ | | - [1] | | ✓ |
| Seismic performance category C2 | - [1] | | | | | | | | |

[1] No performance assessed

**Base materials:**

- Compacted reinforced or unreinforced normal weight concrete without fibres (cracked or uncracked) according to EN 206:2013+A2:2021
- Strength classes C20/25 to C50/60 according to EN 206:2013+A2:2021

**Use conditions (Environmental conditions):**

- Structures subjected to dry internal conditions (FBS II R)
- For all other conditions according to EN 1993-1-4:2006 + A1:2015, corresponding to corrosion resistance class
  - CRC III: for FBS II R

**Design:**

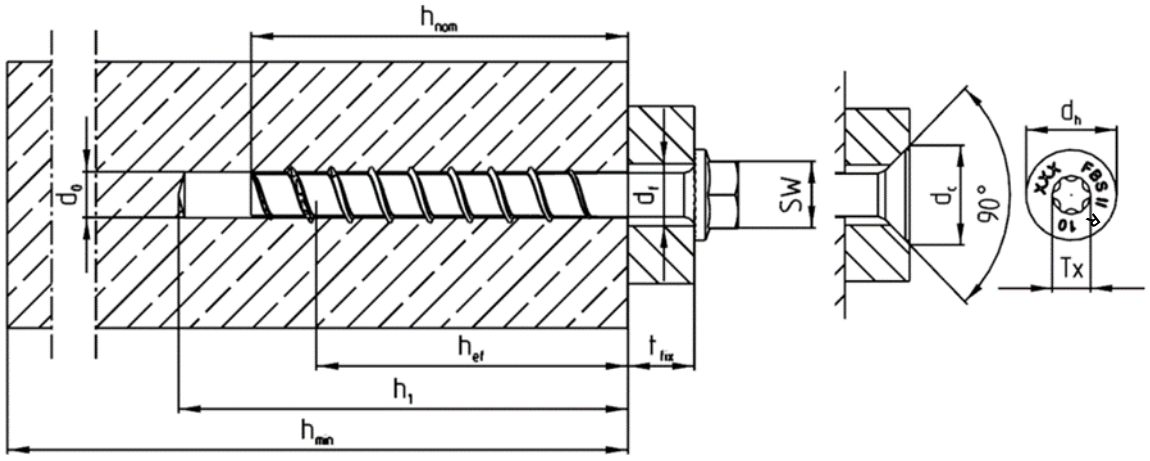
- The structural design according to EN 1992-4:2018 are conducted under responsibility of a designer expierenced in the field of anchorages and concrete works.
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e.g. position of the screw relative to reinforcement or to supports, etc.).
- Design of fastenings according to EN 1992-4:2018 and EOTA Technical Report TR 055:2018

| **fischer concrete screw UltraCut FBS II R** | **Annex B 1** |
|---|---|
| **Intended use**<br>Specification of intended use | |

**Table B2.1:** Installation parameters

| **FBS II R** | | | **6** | **8** | | **10** | | | **12** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal embedment depth | $h_{nom}$ | [mm] | 60 | 50 | 65 | 55 | 65 | 85 | 60 | 75 | 100 |
| Nominal drill hole diameter | $d_0$ | [mm] | 6 | 8 | | 10 | | | 12 | | |
| Cutting diameter of drill bits | $d_{cut} \leq$ | [mm] | 6,40 | 8,45 | | 10,45 | | | 12,50 | | |
| Cutting diameter for diamond drillers | $d_{cut} \leq$ | [mm] | - [1)] | 8,10 | | 10,30 | | | 12,30 | | |
| Clearance hole diameter | $d_f$ | [mm] | 8,0 | 10,6 – 12,0 | | 12,8 – 14,0 | | | 14,8 – 16,0 | | |
| Wrench size (US) | SW | [mm] | 10 / 13 | 13 | | 15 | | | 17 | | |
| TX-size (SK / P / US TX)) | TX | [-] | 30 | 40 | | 50 | | | - | | |
| Countersunk head diameter | $d_h$ | [mm] | 13,3 | 18 | | 21 | | | - | | |
| Countersunk diameter in fixture | $d_c$ | [mm] | 15,2 | 20 | | 23 | | | - | | |
| Drill hole depth | $h_1 \geq$ | [mm] | 70 | 60 | 75 | 65 | 75 | 95 | 70 | 85 | 110 |
| Drill hole depth (with adjustable setting) | $h_1 \geq$ | [mm] | - [1)] | 70 | 85 | 75 | 85 | 105 | 80 | 95 | 120 |
| Thickness of fixture | $t_{fix} \leq$ | [mm] | $L - h_{nom}$ | | | | | | | | |
| Length of screw | $L_{min} =$ | [mm] | 65 | 50 | 65 | 55 | 65 | 85 | 60 | 75 | 100 |
| | $L_{max} =$ | [mm] | 400 | 400 | 415 | 405 | 415 | 435 | 410 | 425 | 450 |
| Torque impact screw driver | $T_{imp,max}$ | [Nm] | 240 | 450 | | | | | 650 | | |
| Torque impact screw driver (with adjustable setting process) | $T_{imp,max}$ | [Nm] | - [1)] | 300 | | | | | 450 | | |

[1)] No performance assessed



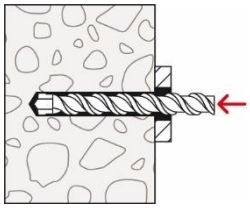

*(Figure not to scale)*

**fischer concrete screw UltraCut FBS II R**

**Annex B 2**

**Intended use**
Installation parameters

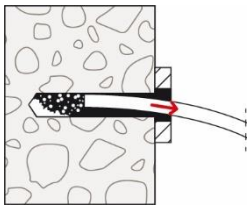
## Installation instruction part 1 FBS II 8/10/12 R



**Step 1: Drilling of the hole:**

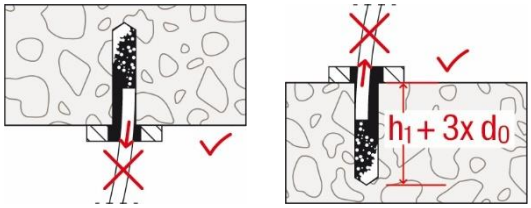
Drill the hole using hammer drill,
hollow drill or diamond core drill

Drill hole diameter $d_0$ and
drill hole depth $h_1$ according to table B2.1



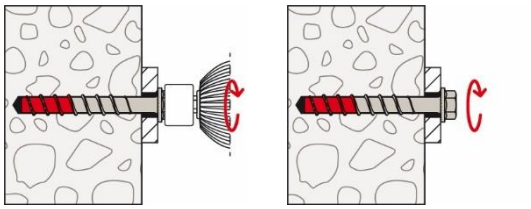
**Step 2: Cleaning of the drill hole - horizontal:**

Clean the drill hole. This step can be omitted in the preparation of the hole by using a hollow drill bit or diamond core drill. (recommendation: use the fischer FHD hollow drill bit)




**Step 2: Cleaning of the drill hole - vertical:**

Cleaning of the drill hole can be omitted, if drilling vertically upwards or if drilling vertically downwards and the hole depth has been increased. It is recommended to increase the drill hole depth by an additional 3 x drilling ø when drilling vertically downwards.

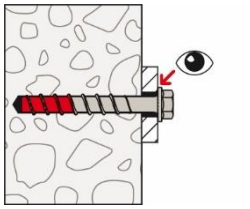


**Step 3: Installation:**

Turn in until the head is in contact with the fixture.

Installation with any torque impact screw driver up to the maximum mentioned torque moment ($T_{imp,max}$ according to table B2.1).

Alternatively, all other tools without an indicated torque moment are allowed (e.g. ratchet spanner). The indicated torque moments $T_{imp,max}$ for impact screw driver are not decisive for manual installation.



**Step 4: Checking of the correct installation:**

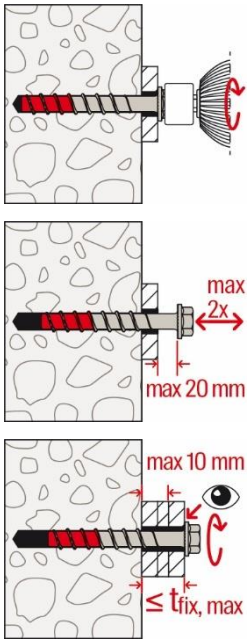
After installation a further turning of the screw must not be possible. The head of the screw must be in contact with the fixture and is not damaged

**fischer concrete screw UltraCut FBS II R**

**Annex B 3**

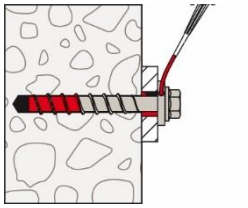
**Intended use**
Installation Instructions

## Installation instruction part 2 FBS II 8/10/12 R




**Adjustment**

Optional:
It is permissible to adjust the screw twice.
Therefore, the screw may be untightened to a maximum of $L_{adj}$ = 20 mm off the surface of the initial fixture. The total permissible thickness of shims added during the adjustment process
is $t_{adj}$ = 10 mm.
The required nominal anchoring depth $h_{nom}$ must be kept after the adjustment process. (see also annex B 3)

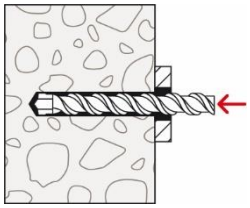
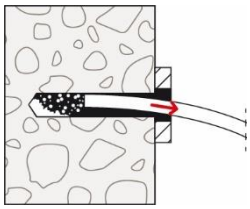
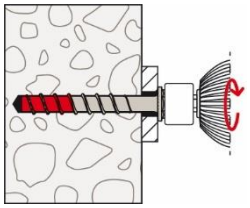
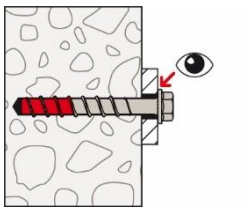


**Filling of the annular gap**

For seismic performance category C2 applications:
The gap between screw shaft and fixture must be filled with mortar; mortar compressive strength ≥ 50 N/mm²
(e. g. FIS V Plus, FIS HB, FIS SB or FIS EM Plus). As an aid for filling the gap, the filling disc FFD is recommended.

| | |
|---|---|
| **fischer concrete screw UltraCut FBS II R** | **Annex B 4** |
| **Intended use**<br>Installation Instructions | |

## Installation instruction FBS II 6 R

| | |
|---|---|
|  | **Step 1: Drilling of the hole:**<br>Drill the hole using hammer drill<br><br>Drill hole diameter $d_0$ and<br>drill hole depth $h_1$ according to table B2.1 |
|  | **Step 2: Cleaning of the drill hole:**<br>Clean the drill hole. |
|  | **Step 3: Installation:**<br>Turn in until the head is in contact with the fixture.<br><br>Installation with any torque impact screw driver up to the maximum mentioned torque moment ($T_{imp,max}$ according to table B2.1). |
|  | **Step 4: Checking of the correct installation:**<br>After installation a further turning of the screw must not be possible. The head of the screw must be in contact with the fixture and is not damaged |

| | |
|---|---|
| **fischer concrete screw UltraCut FBS II R** | **Annex B 5** |
| **Intended use**<br>Installation Instructions | |

**Table C1.1:** Characteristic values for static and quasi-static action

| **FBS II R** | | | | **6** | **8** | | **10** | | | **12** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal embedment depth | | $h_{nom}$ | [mm] | 60 | 50 | 65 | 55 | 65 | 85 | 60 | 75 | 100 |
| **Steel failure for tension load and shear load** | | | | | | | | | | | | |
| Characteristic resistance | | $N_{Rk,s}$ | [kN] | 19,3 | 27,8 | | 43,8 | | | 67,7 | | |
| Partial factor | | $\gamma_{Ms,N}$ | - | 1,5 | | | | | | | | |
| Characteristic resistance | | $V^0_{Rk,s}$ | [kN] | 12,6 | 18,0 | 27,8 | 13,2 | 19,3 | 36,6 | 20,4 | 40,1 | 45,8 |
| Partial factor | | $\gamma_{Ms,V}$ | [-] | 1,25 | | | | | | | | |
| Factor for ductility | | $k_7$ | | 0,75 | | | | | | | | |
| Characteristic bending resistance | | $M^0_{Rk,s}$ | [Nm] | 16,1 | 31,3 | | 68,5 | | | 112,8 | | |
| **Pullout failure** | | | | | | | | | | | | |
| Characteristic resistance in concrete C20/25 | uncracked | $N_{Rk,p}$ | [kN] | 10,0 | 7,0 | 14,0 | 8,5 | 14,0 | ≥ $N^0_{Rk,c}$ [1)] | 10,0 | 12,0 | ≥ $N^0_{Rk,c}$ [1)] |
| | cracked | $N_{Rk,p}$ | [kN] | 4,0 | 4,0 | 9,0 | 4,5 | 6,0 | 16,0 | 4,5 | 11,0 | ≥ $N^0_{Rk,c}$ [1)] |
| Increasing factors concrete | C25/30 | $\psi_c$ | [-] | 1,07 | 1,12 | | | | | | | |
| | C30/37 | | | 1,13 | 1,22 | | | | | | | |
| | C35/45 | | | 1,18 | 1,32 | | | | | | | |
| | C40/50 | | | 1,23 | 1,41 | | | | | | | |
| | C45/55 | | | 1,28 | 1,50 | | | | | | | |
| | C50/60 | | | 1,32 | 1,58 | | | | | | | |
| Installation factor | | $\gamma_{inst}$ | [-] | 1,4 | 1,0 | | | | | | | |
| **Concrete cone failure and splitting failure; concrete pryout failure** | | | | | | | | | | | | |
| Effective embedment depth | | $h_{ef}$ | [mm] | 37 | 40 | 52 | 43 | 51 | 68 | 47 | 60 | 81 |
| Factor for uncracked concrete | | $k_{ucr,N}$ | [-] | 11,0 | | | | | | | | |
| Factor for cracked concrete | | $k_{cr,N}$ | | 7,7 | | | | | | | | |
| Characteristic edge distance | | $c_{cr,N}$ | [mm] | $1,5 \cdot h_{ef}$ | | | | | | | | |
| Characteristic spacing | | $s_{cr,N}$ | | $3 \cdot h_{ef}$ | | | | | | | | |
| Characteristic resistance for splitting | | $N^0_{Rk,sp}$ | [kN] | min{ $N^0_{Rk,c}$, $N_{Rk,p}$ } | 12,0 | 18,4 | 13,0 | 17,9 | ≥ $N^0_{Rk,c}$ [1)] | 15,8 | 22,9 | ≥ $N^0_{Rk,c}$ [1)] |
| Characteristic edge distance for splitting | | $c_{cr,sp}$ | [mm] | $1,78 \cdot h_{ef}$ | $1,5 \cdot h_{ef}$ | | | | | | | |
| Characteristic spacing for splitting | | $s_{cr,sp}$ | | $3 \cdot h_{ef}$ | | | | | | | | |
| Factor for pryout failure | | $k_8$ | [-] | 2,6 | 1,0 | | | | 2,0 | 1,0 | 2,0 | |
| Installation factor | | $\gamma_{inst}$ | | 1,4 [2)] | 1,0 | | | | | | | |
| **Concrete edge failure** | | | | | | | | | | | | |
| Effective length in concrete | | $l_f$ | [mm] | 46 | 50 | 65 | 55 | 65 | 85 | 60 | 75 | 100 |
| Nominal diameter of screw | | $d_{nom}$ | | 6 | 8 | | 10 | | | 12 | | |
| **Adjustment** | | | | | | | | | | | | |
| Maximum thickness of shims | | $t_{adj}$ | [mm] | - [3)] | 10 | | | | | | | |
| Maximum number of adjustments | | $n_a$ | [-] | - [3)] | 2 | | | | | | | |

[1)] $N^0_{Rk,c}$ according to EN 1992-4:2018
[2)] Only for concrete cone failure and splitting failure; concrete pryout failure according to EN 1992-4:2018, Table 4.1
[3)] No performance assessed

**fischer concrete screw UltraCut FBS II R**

**Annex C 1**

**Performances**
Characteristic values for static and quasi-static action

**Table C2.1:** Characteristic values for Seismic Performance Category C1

| **FBS II R** | | | | **6** | **8** | **10** | **12** |
|---|---|---|---|---|---|---|---|
| Nominal embedment depth | | $h_{nom}$ | [mm] | 60 | 65 | 85 | 100 |
| **Steel failure for tension load and shear load C1** | | | | | | | |
| Characteristic resistance | | $N_{Rk,s,C1}$ | [kN] | 19,3 | 27,8 | 43,8 | 67,7 |
| | | $V_{Rk,s,C1}$ | | 7,5 | 18,1 | 29,3 | 36,6 |
| Without filling of the annular gap | | $\alpha_{gap}$ | [-] | 0,5 | | | |
| With filling of the annular gap[1)] | | | | 1,0 | | | |
| **Pullout failure** | | | | | | | |
| Characteristic resistance in cracked concrete | | $N_{Rk,p,C1}$ | [kN] | 3,5 | 9,0 | 16,0 | $\geq N^0_{Rk,c}$[2)] |
| **Concrete cone failure** | | | | | | | |
| Effective embedment depth | | $h_{ef}$ | [mm] | 37 | 52 | 68 | 81 |
| Concrete cone failure | Edge distance | $c_{cr,N}$ | | $1,5 \cdot h_{ef}$ | | | |
| | Spacing | $s_{cr,N}$ | | $3 \cdot h_{ef}$ | | | |
| Installation factor | | $\gamma_{inst}$ | [-] | 1,4 | 1,0 | | |
| **Concrete pryout failure** | | | | | | | |
| Factor for pryout failure | | $k_8$ | [-] | 2,6 | 1,0 | 2,0 | |
| **Concrete edge failure** | | | | | | | |
| Effective length in concrete | | $l_f$ | [mm] | 46 | 65 | 85 | 100 |
| Nominal diameter of screw | | $d_{nom}$ | | 6 | 8 | 10 | 12 |

[1)] Filling of the annular gap according to annex B 4
[2)] $N^0_{Rk,c}$ according to EN 1992-4:2018

**Table C2.2:** Characteristic values for Seismic Performance Category C2

| **FBS II R** | | | | **6** | **8** | **10** | **12** |
|---|---|---|---|---|---|---|---|
| Nominal embedment depth | | $h_{nom}$ | [mm] | - [2)] | 65 | 85 | 100 |
| **Steel failure for tension load and shear load C2** | | | | | | | |
| Characteristic resistance | | $N_{Rk,s,C2}$ | [kN] | - [2)] | 27,8 | 43,8 | 67,7 |
| | | $V_{Rk,s,C2}$ | | | 9,7 | 8,8 | 19,7 |
| With filling of the annular gap[1)] | | $\alpha_{gap}$ | [-] | | 1,0 | | |
| **Pullout failure** | | | | | | | |
| Characteristic resistance in cracked concrete | | $N_{Rk,p,C2}$ | [kN] | - [2)] | 2,8 | 5,0 | 7,3 |
| **Concrete cone failure** | | | | | | | |
| Effective embedment depth | | $h_{ef}$ | [mm] | - [2)] | 52 | 68 | 81 |
| Concrete cone failure | Edge distance | $c_{cr,N}$ | | - [2)] | $1,5 \cdot h_{ef}$ | | |
| | Spacing | $s_{cr,N}$ | | | $3 \cdot h_{ef}$ | | |
| Installation factor | | $\gamma_{inst}$ | [-] | | 1,0 | | |
| **Concrete pryout failure** | | | | | | | |
| Factor for pryout failure | | $k_8$ | [-] | - [2)] | 1,0 | 2,0 | |
| **Concrete edge failure** | | | | | | | |
| Effective length in concrete | | $l_f = h_{nom}$ | [mm] | - [2)] | 65 | 85 | 100 |
| Nominal diameter of screw | | $d_{nom}$ | | | 8 | 10 | 12 |

[1)] Filling of the annular gap according to annex B 4. Application without filling of the annular gap not allowed.
[2)] No performance assessed

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**Annex C 2**

**Performances**
Characteristic values for Seismic Performance Category C1 and C2

**Table C3.1:** Characteristic values for resistance to fire

| **FBS II R** | | | | | **6** | **8** | | **10** | | | **12** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal embedment depth | | | $h_{nom}$ | [mm] | 60 | 50 | 65 | 55 | 65 | 85 | 60 | 75 | 100 |
| **Steel failure for tension load and shear load ($F_{Rk,s,fi} = N_{Rk,s,fi} = V_{Rk,s,fi}$)** | | | | | | | | | | | | | |
| Characteristic resistance for the head shapes | US<br>US TX<br>≥SW13 | $F_{Rk,s,fi}$ | R30 | [kN] | 2,1 | 2,3 | 6,4 | 3,5 | | 11,0 | 4,6 | | 15,2 |
| | | | R60 | | 1,7 | 1,8 | 4,7 | 2,7 | | 8,1 | 3,7 | | 11,2 |
| | | | R90 | | 1,2 | 1,3 | 2,9 | 2,0 | | 5,2 | 2,7 | | 7,3 |
| | | | R120 | | 1,0 | 1,0 | 2,0 | 1,6 | | 3,8 | 2,2 | | 5,3 |
| | SK/P[1)]<br>US SW10[1)] | $F_{Rk,s,fi}$ | R30 | | 1,8 | 2,1 | | 3,0 | | | No performance assessed | | |
| | | | R60 | | 1,4 | 1,7 | | 2,3 | | | | | |
| | | | R90 | | 1,1 | 1,2 | | 1,6 | | | | | |
| | | | R120 | | 0,9 | 1,0 | | 1,2 | | | | | |
| | US<br>US TX<br>≥SW13 | $M^0_{Rk,s,fi}$ | R30 | [Nm] | 1,7 | 2,6 | 7,2 | 7,6 | | 15,4 | 16,8 | | 25,3 |
| | | | R60 | | 1,4 | 2,0 | 5,2 | 6,0 | | 11,4 | 13,3 | | 18,7 |
| | | | R90 | | 1,0 | 1,5 | 3,3 | 4,4 | | 7,3 | 9,8 | | 12,1 |
| | | | R120 | | 0,8 | 1,2 | 2,3 | 3,6 | | 5,3 | 8,0 | | 8,8 |
| | SK/P[1)]<br>US SW10[1)] | $M^0_{Rk,s,fi}$ | R30 | | 1,5 | 2,4 | | 4,2 | | | No performance assessed | | |
| | | | R60 | | 1,2 | 1,9 | | 3,2 | | | | | |
| | | | R90 | | 0,9 | 1,4 | | 2,2 | | | | | |
| | | | R120 | | 0,7 | 1,1 | | 1,7 | | | | | |
| **Pullout failure** | | | | | | | | | | | | | |
| Characteristic resistance | | $N_{Rk,p,fi}$ | R30 | [kN] | 1,0 | 1,7 | 2,4 | 2,1 | 3,5 | 4,3 | 2,5 | 3,0 | 6,3 |
| | | | R60 | | | | | | | | | | |
| | | | R90 | | | | | | | | | | |
| | | | R120 | | 0,8 | 1,4 | 1,9 | 1,7 | 2,8 | 3,4 | 2,0 | 2,4 | 5,0 |
| **Concrete cone failure** | | | | | | | | | | | | | |
| Characteristic resistance | | $N_{Rk,c,fi}$ | R30 | [kN] | 1,4 | 1,6 | 3,4 | 2,1 | 3,2 | 6,6 | 2,6 | 4,8 | 10,2 |
| | | | R60 | | | | | | | | | | |
| | | | R90 | | | | | | | | | | |
| | | | R120 | | 1,1 | 1,3 | 2,7 | 1,7 | 2,6 | 5,3 | 2,1 | 3,8 | 8,1 |
| **Edge distance** | | | | | | | | | | | | | |
| R30 to R120 | | $c_{cr,fi}$ | | [mm] | $2 \cdot h_{ef}$ | | | | | | | | |
| In case of fire attack from more than one side, the minimum edge distance shall be ≥ 300 mm | | | | | | | | | | | | | |
| **Spacing** | | | | | | | | | | | | | |
| R30 to R120 | | $s_{cr,fi}$ | | [mm] | $2 \cdot c_{cr,fi}$ | | | | | | | | |
| **Concrete pryout failure** | | | | | | | | | | | | | |
| R30 to R120 | | $k_8$ | | [-] | 2,6 | 1,0 | | | | 2,0 | 1,0 | 2,0 | |

The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value.
[1)] Only FBS II 6 R

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**Annex C 3**

**Performances**
Characteristic values for resistance to fire

**Table C4.1:** Displacements due to tension loads (static and quasi-static)

| **FBS II R** | | | **6** | **8** | | **10** | | | **12** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal embedment depth | $h_{nom}$ | [mm] | 60 | 50 | 65 | 55 | 65 | 85 | 60 | 75 | 100 |
| Tension load in uncracked concrete | N | [kN] | 5,0 | 3,5 | 7,1 | 4,2 | 7,0 | 11,9 | 5,0 | 6,0 | 17,1 |
| Displacement in uncracked concrete | $\delta_{N0}$ | [mm] | 0,1 | 0,5 | 0,7 | 0,4 | 0,6 | 0,8 | 1,0 | 0,9 | 1,25 |
| | $\delta_{N\infty}$ | | 0,4 | 0,7 | 0,7 | 0,8 | 0,8 | 0,8 | 1,25 | 1,25 | 1,25 |
| Tension load in cracked concrete | N | [kN] | 2,8 | 3,5 | 4,5 | 4,2 | 7,0 | 8,1 | 5,0 | 6,0 | 12,0 |
| Displacement in cracked concrete | $\delta_{N0}$ | [mm] | 0,1 | 0,6 | 0,4 | 0,4 | 0,6 | 0,7 | 0,9 | 0,9 | 1,4 |
| | $\delta_{N\infty}$ | | 0,5 | 1,5 | 1,1 | 1,0 | 1,8 | 1,8 | 1,4 | 1,7 | 1,9 |

**Table C4.2:** Displacements due to shear loads (static and quasi-static)

| **FBS II R** | | | **6** | **8** | | **10** | | | **12** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal embedment depth | $h_{nom}$ | [mm] | 60 | 50 | 65 | 55 | 65 | 85 | 60 | 75 | 100 |
| Shear load in cracked and uncracked concrete | V | [kN] | 7,8 | 11,0 | 15,9 | 10,4 | 11,9 | 20,9 | 12,7 | 24,9 | 26,2 |
| Displacement (the gap between fastener and fixture is subtracted) | $\delta_{V0}$ | [mm] | 2,2 | 4,1 | 2,7 | 1,2 | 1,2 | 3,5 | 1,1 | 2,5 | 2,9 |
| | $\delta_{V\infty}$ | | 3,4 | 6,2 | 4,1 | 1,8 | 1,8 | 5,3 | 1,7 | 3,8 | 4,4 |

**Table C4.3:** Displacements due to tension loads (Seismic Performance Category C2)

| **FBS II R** | | | **6** | **8** | **10** | **12** |
|---|---|---|---|---|---|---|
| Nominal embedment depth | $h_{nom}$ | [mm] | - [1)] | 65 | 85 | 100 |
| Displacement DLS | $\delta_{N,C2\ (DLS)}$ | | | 0,9 | 0,9 | 1,1 |
| Displacement ULS | $\delta_{N,C2\ (ULS)}$ | | | 2,5 | 2,7 | 3,2 |

**Table C4.4:** Displacements due to shear loads (Seismic Performance Category C2)

| **FBS II R** | | | **6** | **8** | **10** | **12** |
|---|---|---|---|---|---|---|
| Nominal embedment depth | $h_{nom}$ | [mm] | - [1)] | 65 | 85 | 100 |
| Displacement DLS | $\delta_{V,C2\ (DLS)}$ | | | 1,6 | 1,7 | 2,6 |
| Displacement ULS | $\delta_{V,C2\ (ULS)}$ | | | 5,0 | 3,8 | 6,6 |

[1)] No performance assessed

**Table C4.5:** Minimum thickness of concrete members, minimum spacing and edge distance

| **FBS II R** | | | **6** | **8** | | **10** | | | **12** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal embedment depth | $h_{nom}$ | [mm] | 60 | 50 | 65 | 55 | 65 | 85 | 60 | 75 | 100 |
| Minimum thickness of concrete member | $h_{min}$ | | 100 | 100 | 120 | 100 | 120 | 140 | 110 | 130 | 150 |
| Minimum spacing | $s_{min}$ | | 35 | | | 40 | | | 50 | | |
| Minimum edge distance | $c_{min}$ | | 35 | | | 40 | | | 50 | | |

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**Annex C 4**

**Performances**
Displacements due to tension and shear loads;
Minimum thickness of concrete members, minimum spacing and edge distance