Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-22/0724 of 9 February 2023

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	FAKKT concrete screw BS
Product family to which the construction product belongs	Mechanical fasteners for use in concrete
Manufacturer	Keller & Kalmbach GmbH Siemensstraße 19 85716 Unterschleißheim DEUTSCHLAND
Manufacturing plant	Herstellwerk 1
This European Technical Assessment contains	15 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330232-01-0601, Edition 05/2021

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Specific Part

1 Technical description of the product

The FAKKT concrete screw BS is an anchor of sizes 8, 10, 12 and 14 mm made of hardened carbon steel. The anchor is screwed into a predrilled cylindrical drill hole. The special thread of the anchor cuts an internal thread into the member while setting. The anchorage is characterised by mechanical interlock in the special thread.

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 B 3 and C 1
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1
Displacements	See Annex C 5
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 2, C3 and C 5

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 4

3.3 Aspects of durability

Essential characteristic	Performance
Durability	See Annex B 1

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

In accordance with European Assessment Document EAD No. 330232-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

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

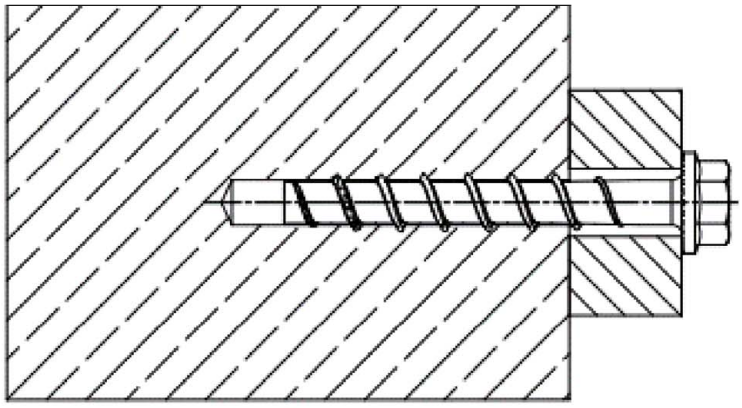
Issued in Berlin on 9 February 2023 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

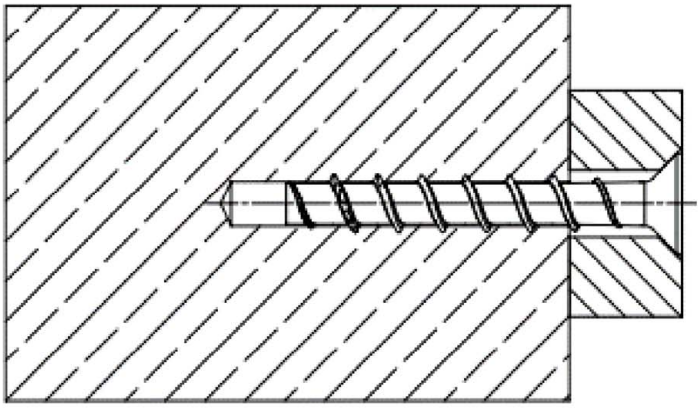
beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

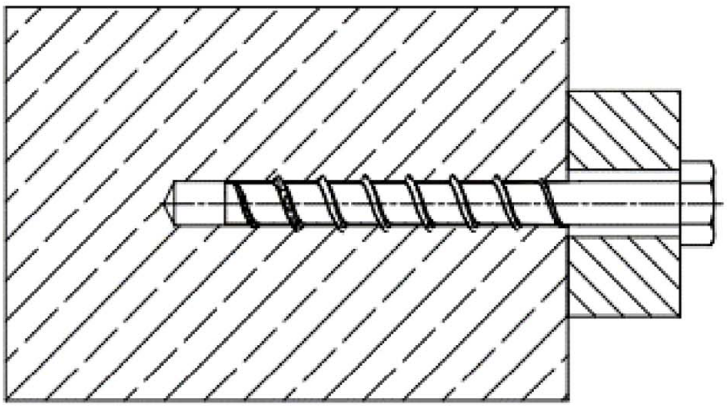
FAKKT concrete screw BS in installed condition



BS US



BS SK



BS S

(Fig. not to scale)

FAKKT concrete screw BS	**Annex A 1**
Product description Product in the installed condition	

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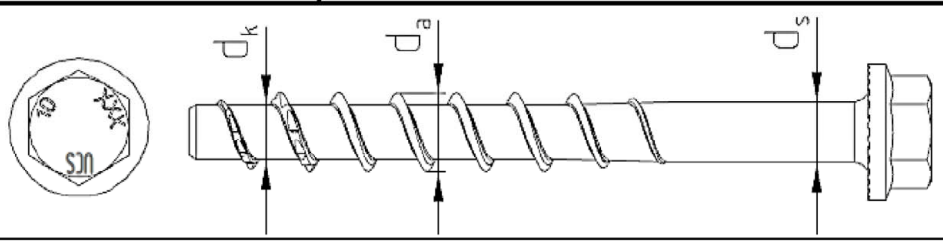
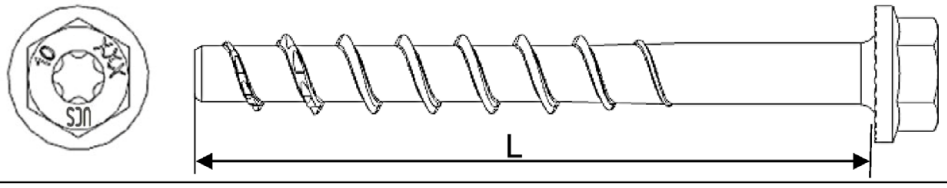
Table A2.1: Material and screw types

Type of screw / size			BS US / SK / S			
			8	**10**	**12**	**14**
Thread outer diameter	d_a	[mm]	10,3	12,5	14,5	16,6
Core diameter	d_k		7,4	9,4	11,3	13,3
Shaft diameter	d_s		8,0	9,9	11,7	13,7
Material			Hardened carbon steel; $A_{5\%} \geq 8\%$			
Coating			galvanized			

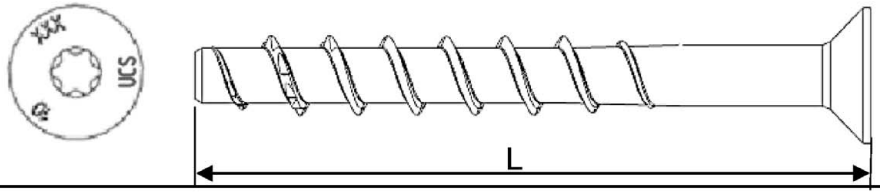
Hexagon head with formed washer (US)



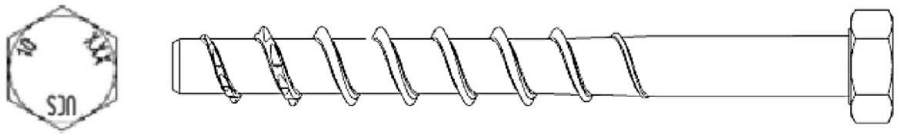
Hexagon head with formed washer (US TX)



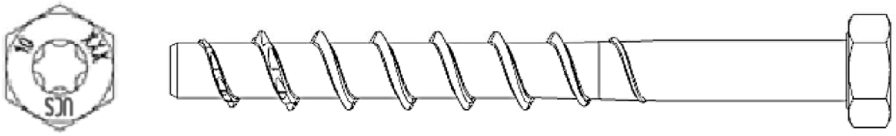
Countersunk Head (SK)



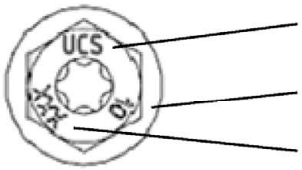
Hexagon Head (S)



Hexagon Head (S TX)



Head Marking: Product description **UCS –** Trade name **FAKKT concrete screw BS**



UCS : Product description

10: screw size

XXX: screw length

(Fig. not to scale)

FAKKT concrete screw BS

Product description
Material and screw types

Annex A 2

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Specifications of intended use

Table B1.1: Anchorages subject to

Size	**8**		**10**			**12**			**14**		
Nominal embedment depth [mm]	50	65	55	65	85	60	75	100	65	85	115
Static and quasi-static loads in cracked and uncracked concrete	✓										
Fire exposure											
Seismic performance category C1		✓		✓			✓			✓	
Seismic performance category C2											

Base materials:

- Reinforced and unreinforced normal weight concrete according to EN 206:2013+A2:2021
- Strength classes C20/25 to C50/60 according to EN 206:2013+A2:2021
- Non-cracked or cracked concrete: All sizes and all embedment depths

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions.

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 screw 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, Edition February 2018

Installation:

- Hammer drilling or diamond drilling or hollow drilling according to Annex B4: All sizes and all embedment depths
- Screw installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters on site
- In case of aborted hole: New hole must be drilled at a minimum distance of twice the depth of the aborted hole or closer, if the hole is filled with a high strength mortar and only if the hole is not in the direction of the oblique tensile or shear load
- Adjustability according to Annex B3 for: All sizes and all embedment depths
- Cleaning of drill hole is not necessary when using a hollow drill or:
  - If drilling vertically upwards
  - If drilling vertical downwards and the drill hole depth has been increased. It is recommended to increase the drill depth with additional 3 d_0.
- After correct installation further turning of the screw head should not be possible
- The head of the screw must be fully engaged on the fixture and show no signs of damage
- For Seismic Performance Category C2 applications: The gap between screw shaft and fixture must be filled with mortar; compressive strength ≥ 50 N/mm² (for example FAKKT IM Z).

FAKKT concrete screw BS	**Annex B 1**
Intended Use Specifications	

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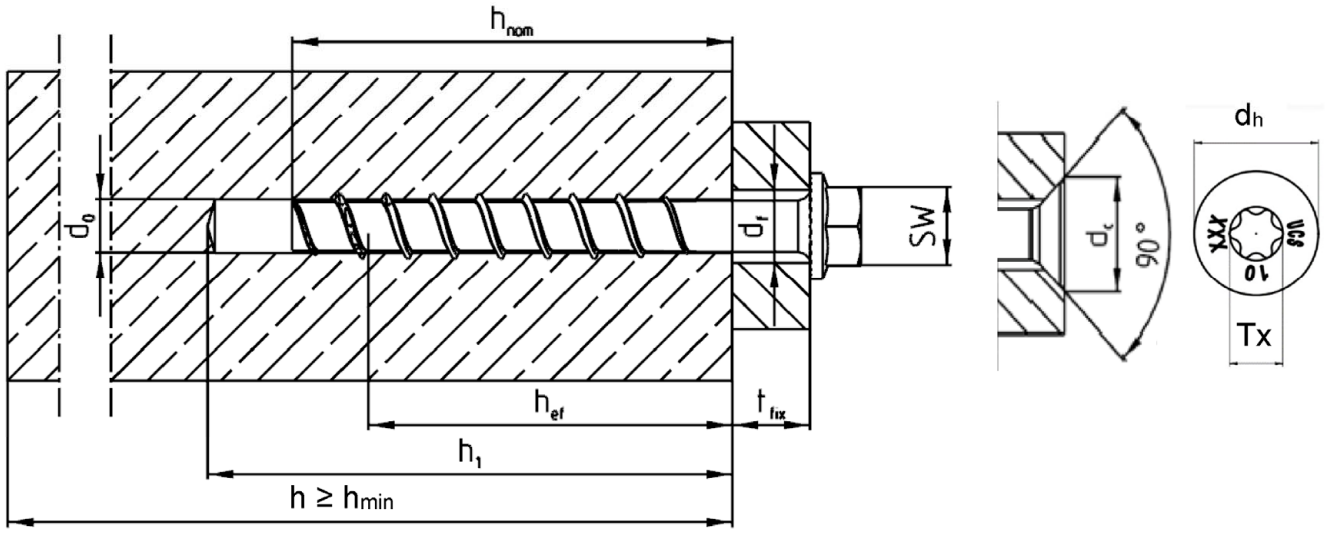
Table B2.1: Installation parameters

screw size			BS										
			8		10			12			14		
Nominal embedment depth	h_{nom}	[mm]	50	65	55	65	85	60	75	100	65	85	115
Nominal drill hole diameter	d_0		8		10			12			14		
Cutting diameter of drill bits	$d_{cut} \leq$		8,45		10,45			12,50			14,50		
Cutting diameter of diamond drillers	$d_{cut} \leq$		8,10		10,30			12,30			14,30		
Clearance hole diameter	d_f		10,6 – 12,0		12,8 – 14,0			14,8 – 16,0			16,9 – 18,0		
Wrench size (US,S)	SW		13		15			17			21		
Tx size	Tx	-	40		50			-[1]			-[1]		
Countersunk head diameter	d_h		18		21			-[1]			-[1]		
Countersunk diameter in fixture	d_c		20		23			-[1]			-[1]		
Drill hole depth	$h_1 \geq$		60	75	65	75	95	70	85	110	80	100	130
Drill hole depth (with adjustable setting process)	$h_1 \geq$	[mm]	70	85	75	85	105	80	95	120	90	110	140
Thickness of fixture	$t_{fix} \leq$		$L - h_{nom}$										
Length of screw	$L_{min} =$		50	65	55	65	85	60	75	100	65	85	115
	$L_{max} =$		400	415	405	415	435	410	425	450	415	435	465
Torque impact screw driver	$T_{imp,max}$	[Nm]	600		650								

[1] Fastener type not part of the ETA



(Fig. not to scale)

FAKKT concrete screw BS

Intended Use
Installation parameters

Annex B 2

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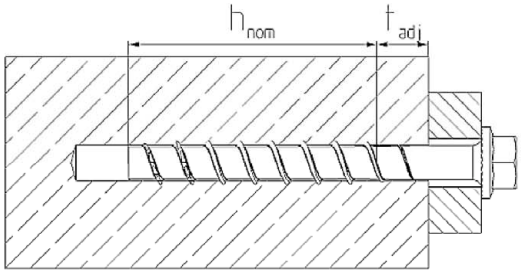
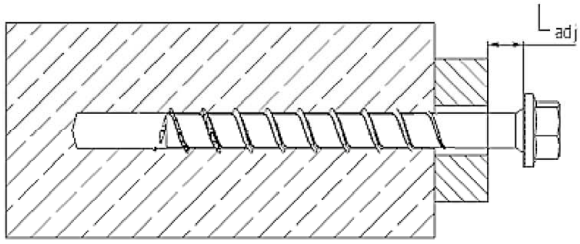
Adjustment

1)



2)



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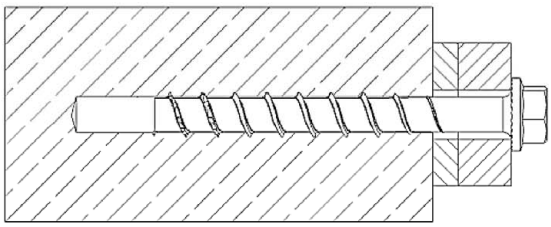
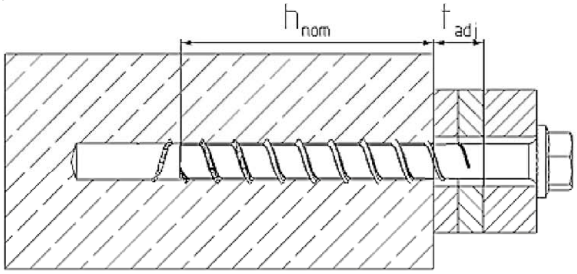


4)



It is permissible to untighten the screw up to two times for adjustment purposes.
Therefor the screw may be untighten 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.

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

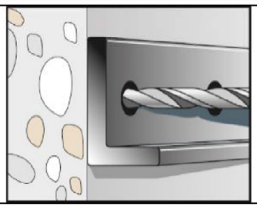
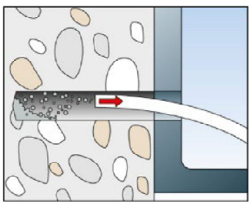
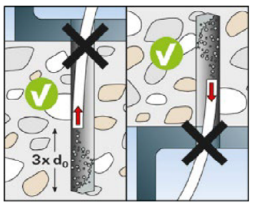
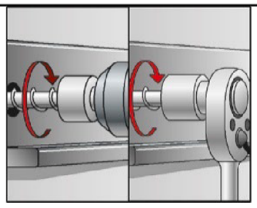
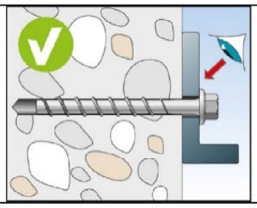
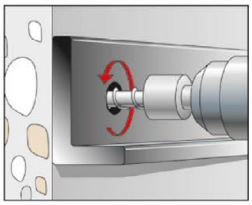
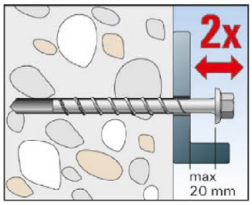
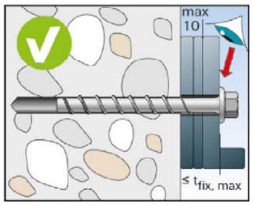
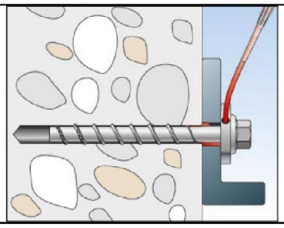
Screw size			BS											
			8		10			12			14			
Nominal embedment depth	h_{nom}	[mm]	50	65	55	65	85	60	75	100	65	85	115	
Minimum thickness of concrete member	h_{min}	[mm]	100	120	100	120	140	110	130	150	120	140	180	
Minimum spacing	s_{min}	[mm]	35		40			50			60			
Minimum edge distance	c_{min}	[mm]	35		40			50			60			

(Fig. not to scale)

FAKKT concrete screw BS	**Annex B 3**
Intended Use Adjustment Minimum thickness of concrete members, minimum spacing and edge distance	

Deutsches Institut für Bautechnik DIBt

Installation instruction

	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
a)  b) 	Option a): Clean the drill hole Option b): Cleaning of drill hole is not necessary when using a hollow drill or a diamond drill or: - If drilling vertically upwards or - If drilling vertically downwards and the drill hole depth has been increased. It is recommended to increase the drill hole depth additional 3 times d_0.
	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 for impact screw driver are therefore not decisive.
	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
1.  2.  3. 	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.
	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. FAKKT IM Z)

FAKKT concrete screw BS	**Annex B 4**
Intended Use Installation instructions	

Deutsches Institut für Bautechnik DIBt

Table C1.1: Performance for static and quasi-static action

Screw size				BS											
				8		10			12			14			
Nominal embedment depth		h_{nom}	[mm]	50	65	55	65	85	60	75	100	65	85	115	
Steel failure for tension load and shear load															
Characteristic resistance		$N_{Rk,s}$	[kN]	35		55			76			103			
Partial factor		γ_{Ms}	[-]	1,4											
Characteristic resistance		$V_{Rk,s}$	[kN]	13,1	19,0	29,4		34,9	31,9		42,7	46,5		61,7	
Partial factor		γ_{Ms}	[-]	1,5											
Factor for ductility		k_7	[-]	1,0											
Characteristic bending resistance		$M^0_{Rk,s}$	[Nm]	51		95			165			269			
Pullout failure															
Characteristic resistance in concrete C20/25	uncracked	$N_{Rk,p}$	[kN]	≥ $N^0_{Rk,c}$ [1]											
	cracked			6	12	9	12	≥ $N^0_{Rk,c}$ [1]							
Increasing factor $N_{Rk,p}$ = $\psi_c \cdot N_{Rk,p}(C20/25)$	C25/30	ψ_c	[-]	1,12											
	C30/37			1,22											
	C35/45			1,32											
	C40/50			1,41											
	C45/55			1,50											
	C50/60			1,58											
Installation factor		γ_{inst}	[-]	1,0											
Concrete cone failure and splitting failure; Concrete pryout failure															
Effective embedment depth		h_{ef}	[mm]	40	52	43	51	68	47	60	81	50	67	93	
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 h_{ef}											
Characteristic spacing		$s_{cr,N}$		3 h_{ef}											
Characteristic edge distance for splitting		$c_{cr,sp}$		1,5 h_{ef}											
Characteristic spacing for splitting		$s_{cr,sp}$		3 h_{ef}											
Characteristic resistance for splitting		$N^0_{Rk,sp}$	[kN]	min ($N^0_{Rk,c}$ [1], $N_{Rk,p}$)											
Factor for pryout failure		k_8	[-]	1,0	2,0	1,0	2,0								
Installation factor		γ_{inst}		1,0											
Concrete edge failure															
Effective length in concrete		l_f	[mm]	50	65	55	65	85	60	75	100	65	85	115	
Nominal diameter of screw		d_{nom}		8		10			12			14			
Adjustment															
max. thickness of adjustment layers		t_{adj}	[mm]	10											
Max. number of adjustments		n_a	[-]	2											

[1] $N^0_{Rk,c}$ according EN 1992-4:2018

FAKKT concrete screw BS

Performances
Performance for static and quasi-static action

Annex C 1

Deutsches Institut für Bautechnik DIBt

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

Screw size				BS			
				8	10	12	14
Nominal embedment depth		h_{nom}	[mm]	65	85	100	115
Steel failure for tension load and shear load C1							
Characteristic resistance		$N_{Rk,s,eq,C1}$	[kN]	35	55	76	103
		$V_{Rk,s,eq,C1}$		11,4	22,3	26,9	38,3
Without filling of the annular gap[1)]		α_{gap}	[-]	0,5			
With filling of the annular gap[1]				1,0			
Pullout failure							
Characteristic resistance in cracked concrete		$N_{Rk,p,eq,C1}$	[kN]	12	≥ $N^0_{Rk,c}$[2)]		
Concrete cone failure							
Effective embedment depth		h_{ef}	[mm]	52	68	81	93
Concrete cone failure	Edge distance	$c_{cr,N}$		1,5 h_{ef}			
	Spacing	$s_{cr,N}$		3 h_{ef}			
Installation factor		γ_{inst}	[-]	1,0			
Concrete pryout failure							
Factor for pryout failure		k_8	[-]	2,0			
Concrete edge failure							
Effective length in concrete		l_f	[mm]	65	85	100	115
Nominal diameter of screw		d_{nom}		8	10	12	14

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

FAKKT concrete screw BS

Performances
Characteristic values for Seismic Performance Category C1

Annex C 2

Deutsches Institut für Bautechnik DIBt

Table C3.1: Characteristic values for Seismic Performance Category C2
Gap between screw shaft and fixture must be filled with mortar

Screw size				BS			
				8	10	12	14
Nominal embedment depth		h_{nom}	[mm]	65	85	100	115
Steel failure for tension load and shear load C2							
Characteristic resistance		$N_{Rk,s,eq,C2}$	[kN]	35,0	55	76,0	103
		$V_{Rk,s,eq,C2}$		13,3	20,4	29,9	35,2
With filling of the annular gap		α_{gap}	[-]	1,0			
Pullout failure							
Characteristic resistance in cracked concrete		$N_{Rk,p,eq,C2}$	[kN]	2,1	6,0	8,9	17,1
Concrete cone failure							
Effective embedment depth		h_{ef}		52	68	81	93
Concrete cone failure	Edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}			
	Spacing	$s_{cr,N}$		3 h_{ef}			
Installation factor		γ_{inst}	[-]	1,0			
Concrete pryout failure							
Factor for pryout failure		k_8	[-]	2,0			
Concrete edge failure							
Effective length in concrete		l_f	[mm]	65	85	100	115
Nominal diameter of screw		d_{nom}		8	10	12	14

FAKKT concrete screw BS

Performances
Characteristic values for Seismic Performance Category C2

Annex C 3

Deutsches Institut für Bautechnik DIBt

Table C4.1: Characteristic values for resistance to fire[1)]

Screw size					BS										
					8		10			12			14		
Minimum embedment depth			h_{nom}	[mm]	50	65	55	65	85	60	75	100	65	85	115
Steel failure for tension load and shear load ($F_{Rk,s,fi} = N_{Rk,s,fi} = V_{Rk,s,fi}$)															
Characteristic resistance for head shape	US, S	R30	$F_{Rk,s,fi}$	[kN]	2,33		3,45			4,62			6,46		
		R60			1,82		2,73			3,66			5,11		
		R90			1,30		2,00			2,69			3,75		
		R120			1,04		1,64			2,20			3,08		
	SK, US TX, S TX	R30	$F_{Rk,s,fi}$	[kN]	2,12		2,96			-[2)]			-[2)]		
		R60			1,67		2,26			-[2)]			-[2)]		
		R90			1,21		1,56			-[2)]			-[2)]		
		R120			0,99		1,21			-[2)]			-[2)]		
	All head shapes	R30	$M^0_{Rk,s,fi}$	[Nm]	2,62		4,92			7,83			12,89		
		R60			2,05		3,89			6,20			10,19		
		R90			1,46		2,85			4,56			7,48		
		R120			1,17		2,34			3,73			6,14		
Pullout failure															
Characteristic resistance		R30	$N_{Rk,p,fi}$	[kN]	1,5	3,0	2,3	3,0	5,0	2,9	4,2	6,6	3,2	4,9	8,1
		R60													
		R90													
		R120			1,2	2,4	1,8	2,4	4,0	2,3	3,3	5,2	2,5	3,9	6,5
Concrete cone failure															
Characteristic resistance		R30	$N_{Rk,c,fi}$	[kN]	1,6	3,4	2,1	3,2	6,6	2,6	4,8	10,2	3,0	6,3	14,4
		R60													
		R90													
		R120			1,3	2,7	1,7	2,6	5,3	2,1	3,8	8,1	2,4	5,1	11,5
Edge distance															
R30 to R120			$c_{cr,fi}$	[mm]	2 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 $c_{cr,fi}$										

1) The embedment depth has to be increased for wet concrete by at least 30 mm compared to the given value

2) No performance assessed

FAKKT concrete screw BS

Performances:
Characteristic values for resistance to fire

Annex C 4

Deutsches Institut für Bautechnik DIBt

Table C5.1: Displacements due to tension loads (static)

Screw size			BS										
			8		10			12			14		
Nominal embedment depth	h_{nom}	[mm]	50	65	55	65	85	60	75	100	65	85	115
Tension load in cracked concrete	N	[kN]	2,9	5,7	4,3	5,7	9,6	5,5	8,0	12,5	6,1	9,4	15,3
Displacement	δ_{N0}	[mm]	0,5	0,9	0,7	0,7	0,8	0,7	0,9	0,8	0,8	1,0	0,8
	$\delta_{N\infty}$		1,3	1,0	0,7	0,7	0,8	1,3	0,9	0,8	1,1	1,0	1,1
Tension load in non - cracked concrete	N	[kN]	7,9	12,0	6,8	8,8	13,5	7,7	11,0	17,4	8,5	13,2	21,6
Displacement	δ_{N0}	[mm]	0,9	1,4	0,9	0,9	1,4	0,9	1,1	1,4	1,0	1,3	1,1
	$\delta_{N\infty}$		1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,4	1,1	1,3	1,1

Table C5.2: Displacements due to shear loads (static)

Screw size			BS										
			8		10			12			14		
Nominal embedment depth	h_{nom}	[mm]	50	65	55	65	85	60	75	100	65	85	115
Shear load in cracked and non-cracked concrete	V	[kN]	6,2	9,0	14,0	14,0	16,6	15,9	15,9	21,2	23,0	23,0	30,5
Displacement	δ_{V0}	[mm]	1,4	1,4	3,2	3,2	3,2	2,5	2,5	3,4	2,8	2,8	5,4
	$\delta_{V\infty}$		2,0	2,1	4,9	4,9	4,9	3,8	3,8	5,1	4,2	4,2	8,1

Table C5.3: Displacements due to tension loads (Seismic Performance Category C2)

Screw size			BS			
			8	10	12	14
Nominal embedment depth	h_{nom}	[mm]	65	85	100	115
Displacement DLS	$\delta_{N,eq(DLS)}$	[mm]	0,5	0,8	0,9	1,3
Displacement ULS	$\delta_{N,eq\ (ULS)}$		1,7	2,8	2,7	5,0

Table C5.4: Displacements due to shear loads (Seismic Performance Category C2)

Screw size			BS			
			8	10	12	14
Nominal embedment depth	h_{nom}	[mm]	65	85	100	115
Displacement DLS	$\delta_{V,eqDLS)}$	[mm]	1,6	2,7	3,1	4,1
Displacement ULS	$\delta_{V,eq\ (ULS)}$		3,9	7,1	5,3	8,7

FAKKT concrete screw BS

Performances:
Displacements under tension and shear loads

Annex C 5