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-17/0629 of 16 June 2018

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	Betongskrue Op. 1
Product family to which the construction product belongs	Mechanical fasteners for use in concrete
Manufacturer	HITACHI POWER TOOLS NORWAY AS Kjeller Vest 7 2007 KJELLER NORWEGEN
Manufacturing plant	Taiwan plant no. 1
This European Technical Assessment contains	18 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 330232-00-0601
This version replaces	ETA-17/0629 issued on 21 August 2017

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Specific Part

1 Technical description of the product

The Betongskrue Op. 1 of sizes SK 8, SK 10 and SK 12 is and anchor made of galvanized or stainless 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 concrete screw 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 concrete screw of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	see Annex C 1 and C 2
Characteristic resistance to shear load (static and quasi-static loading)	see Annex C 4
Displacements (static and quasi-static loading)	see Annex C 3 and C 5
Characteristic resistance and displacements for seismic performance categories C1 and C2	No performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 6 and C 7

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

In accordance with European Assessment Documents EAD No. 330232-00-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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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 16 June 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Baderschneider

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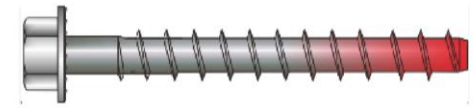
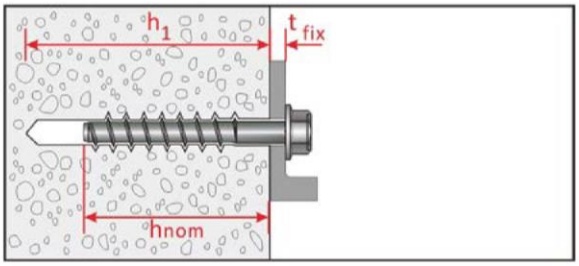
Product in the installed condition

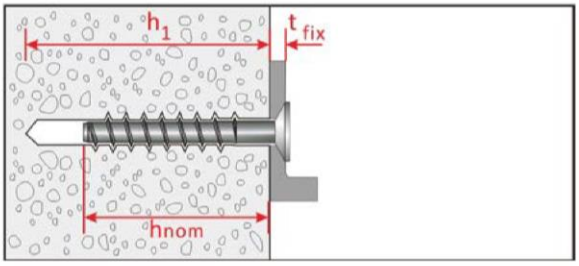


Steel 10B21

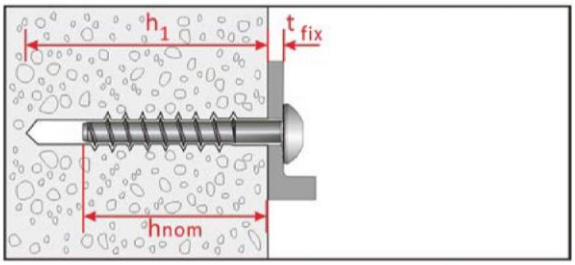
Stainless steel A4



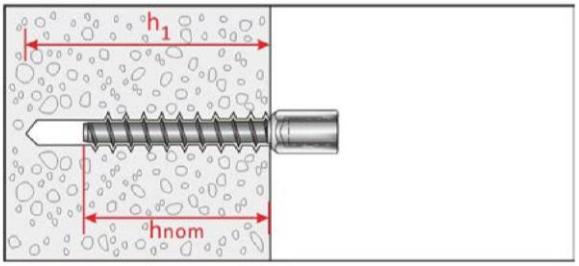
Hexagon Head : SK-H, SK-HF
10B21 (SK8, SK10, SK12)
A4 (SK8, SK10, SK12)



Countersunk Head : SK-CS
10B21 (SK8, SK10)
A4 (SK8, SK10)



Pan Head : SK-PH
10B21 (SK8, SK10)
A4 (SK8, SK10)



Hanger Bolt : SK-HB
A4 (SK10-M12)

Betongskrue Op. 1	**Annex A1**
Product description Installed condition	

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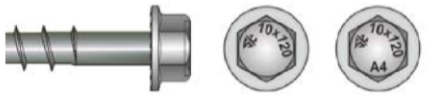
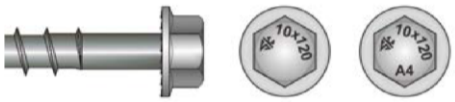
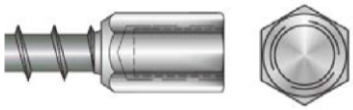
Table A1: Materials and screw types

Name	Material
Screw fastener	

Head marking	material
SK	Steel 10B21 acc. to SAE-J403 zinc coating: electroplated (> 5 µm) or mechanical plated (> 30 µm) (only head type –H and –HF)
SK A4	Stainless steel 1.4401, 1.4404 (both A4)

Anchor size / head types			SK 8			SK 10			SK 12	
			-H -HF -CS -PH	-H -HF	-CS -PH	-H -HF -CS -PH	-H -HF -HB	-CS -PH	-H -HF	
Material			10B21	A4		10B21	A4		10B21	A4
Characteristic yield strength	f_{yk}	N/mm²	780	640	432	750	640	432	750	640
Characteristic tensile strength	f_{uk}	N/mm²	870	800	540	850	800	540	850	800
Elongation at rupture	As	[%]	≤ 8							

	Hexagon washer head 1) SK-H size 8,10,12 (10B21 steel) 2) SK-H A4 size 8,10,12 (stainless A4)
	Hexagon washer head 3) SK-HF size 8,10,12 (10B21 steel) 4) SK-HF A4 size 8,10,12 (stainless A4)
	Countersunk head 5) SK-CS size 8,10 (10B21 steel) 6) SK-CS A4 size 8,10 (stainless A4)
	Pan head 7) SK-PH size 8,10 (10B21 steel) 8) SK-PH A4 size 8,10 (stainless A4)
	Hanger Bolt head 9) SK-HB A4 size 10 with M12 internal thread (stainless A4)

Betongskrue Op. 1

Product description
Materials and screw types

Annex A2

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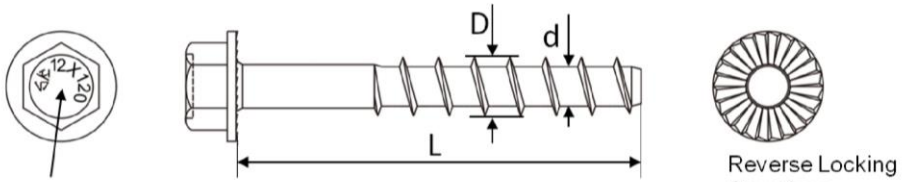
Table A2: Dimensions and markings

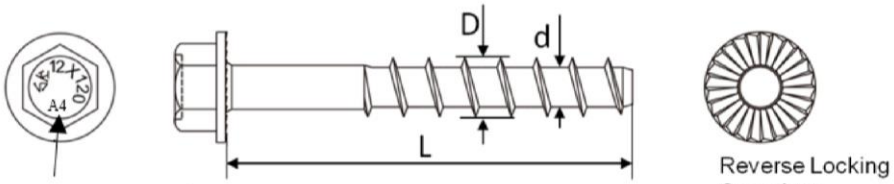
Fastener size			SK 8				SK 10				SK 12	
Head type			H, HF, PH		CS		H, HF, PH, HB		CS		H, HF	
Material			10B21	A4	10B21	A4	10B21	A4	10B21	A4	10B21	A4
Embedment depth	h_{nom}	[mm]	65	85	65	85	75	100	75	100	95	120
Length of fastener	min L	[mm]	70	90	75	95	80	105	85	110	100	125
	max L	[mm]	150				150				150	
Thread diameter	D	[mm]	9,9				12,5				14,3	
Shaft diameter	d	[mm]	7,4				9,4				11,3	
Thread pitch	p	[mm]	5,8				7,7				8,1	

Steel
10B21



Head marking:
Identifying mark of producer: SK
Nominal size: e.g. 12 mm
Length L: e.g. 120 mm

Stainless Steel
A4



Head marking:
Identifying mark of producer: SK
Nominal size: e.g. 12mm
Length L: e.g. 120mm
Material: A4

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Betongskrue Op. 1	Annex A3
Product description Dimensions and markings	

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Specifications of Intended use

Anchorages subject to:

- Static and quasi-static loads: All sizes.
- Fire exposure: All sizes

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000,
- Strength classes C20/25 to C50/60 according to EN 206-1:2000,
- Uncracked or cracked concrete: all sizes.

Use conditions (Environmental conditions)

- Anchorages subject to dry internal conditions. (zinc plated steel and stainless steel)
- Anchorages subject to external atmospheric exposure (including industrial and marine environment) or exposure in permanently damp internal conditions if no particular aggressive conditions exist. (Stainless steel)

  Note: Particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere or indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used)

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e. g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages are designed in accordance with FprEN 1992-4:2016 and TR 055, Edition December 2016

Installation:

- Hammer drilling only: all sizes and all embedment depths.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted hole is filled with high strength mortar and if under shear or oblique tension load it is not the direction of the load application.
- After installation further turning of the anchor shall not be possible.
- The head of the anchor must be fully engaged on the fixture and show no signs of damage.

Betongskrue Op. 1	Annex B1
Intended Use Specifications	

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Table B1: Installation parameters (Steel 10B21)

Fastener size			SK 8			SK 10			SK 12
Head type			H HF	CS	PH	H HF	CS	PH	H HF
Material			Steel 10B21						
Diameter of drill bit	d_0	[mm]	8			10			12
Embedment depth	h_{nom}	[mm]	65			75			95
Min. hole depth in concrete	$h_1 \geq$	[mm]	75			85			105
Effective anchorage depth	h_{ef}	[mm]	50,6			58,1			75,4
Clearance hole in the fixture	d_f	[mm]	11			13			15
Thickness of fixture	t_{fix}	[mm]	5-85	10-85	5-85	5-75	10-75	5-75	5-55
Installation torque	T_{inst}	[Nm]	40	-[1)]	-[1)]	60	-[1)]	-[1)]	80
Wrench size (types: H, HF, HI)	WS	[mm]	13	-	-	17	-	-	19
Torx size (types: CS, PH)	TX	-	-	45		-	50		-
Max. power output, machine setting	$T_{max} \leq$	[Nm]	185	120	120	350	120	120	350

1) For the installation of the CS and PH head types only impact screw driver can be used.

Table B2: Installation parameters (Stainless Steel A4)

Fastener size			SK8			SK 10				SK 12
Head type			H HF	CS	PH	H HF	HB	CS	PH	H HF
Material			Stainless A4							
Diameter of drill bit	d_0	[mm]	8			10				12
Embedment depth	h_{nom}	[mm]	85			100				120
Min. hole depth in concrete	$h_1 \geq$	[mm]	95			110				130
Effective anchorage depth	h_{ef}	[mm]	51,9			58,7				75,6
Clearance hole	d_f	[mm]	11			13				15
Thickness of fixture	t_{fix}	[mm]	5-65	10-65	5-65	5-50	5-50	10-50	5-50	5-30
Installation torque	T_{inst}	[Nm]	-[1)]	-[1)]	-[1)]	-[1)]	-[1)]	-[1)]	-[1)]	-[1)]
Wrench size (types: H, HF, HI)	WS	[mm]	13	-	-	17	19	-	-	19
Torx size (types: CS, PH)	TX	-	-	45		-	-	50		-
Max. torque moment, machine setting	$T_{max} \leq$	[Nm]	120	120	120	185	185	185	185	185

1) For the installation of the CS and PH head types only impact screw driver can be used.

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Betongskrue Op. 1	Annex B2
Intended Use Installation parameters	

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Table B3: Minimum thickness of member, Minimum spacing and edge distance

Fastener size			**SK 8**		**SK 10**		**SK 12**	
Head type			**H, HF, CS, PH**		**H, HF, CS, PH, HB**		**H,HF**	
Material			**10B21**	**A4**	**10B21**	**A4**	**10B21**	**A4**
Minimum member thickness	h_{min}	[mm]	110	125	130	140	160	170
Minimum edge distance	c_{min}	[mm]	50	50	60	60	70	70
Minimum spacing	s_{min}	[mm]	50	50	60	60	70	70

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Betongskrue Op. 1	**Annex B3**
Intended Use Minimum member thickness, minimum edge distance and anchor spacing	

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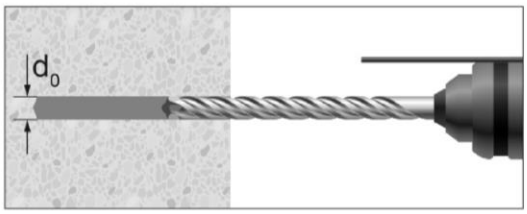
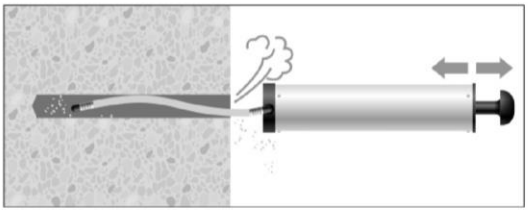
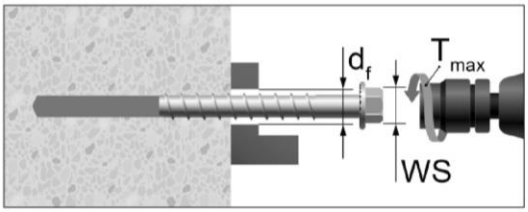
Installation instruction



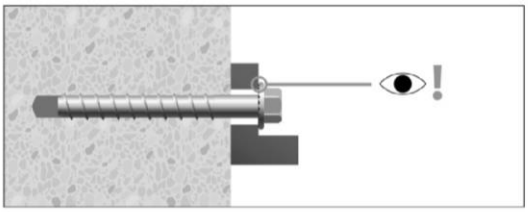
Drill the hole to the bore hole depth $\mathbf{h_1}$.



Clean the hole.



Screw in the anchor by using a torque wrench or an impact screw driver.
In case of using torque wrench: T_{inst} acc. to Table B1 and B2.
In case of using impact screw driver: T_{max} acc. to Table B1 and B2
WS= Wrench Size



Control of complete setting, full contact of screw head with fixture part.

Betongskrue Op. 1	Annex B4
Intended Use Installation Instruction	

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Table C1:
Characteristic resistance under tension loading (Steel 10B21)

Fastener size			**SK 8**			**SK 10**			**SK 12**
Head type			**H HF**	**CS**	**PH**	**H HF**	**CS**	**PH**	**H HF**
Material			**Steel 10B21**						
Steel failure									
Characteristic resistance	$N_{Rk,s}$	[kN]	35,9			57,0			83,0
Partial factor	γ_{Ms} [2)]	[-]	1,4			1,4			1,4
Pull-out failure									
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	4,5			10,0			12,0
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	9,0	9,0	6,5	16,0	16,0	11	25,0
Increasing factors for $N_{Rk,p}$ in cracked or uncracked concrete	ψ_c	C30/37	1,22						
		C40/50	1,41						
		C50/60	1,58						
Installation factor	γ_{inst}	[-]	1,4			1,0			1,2
Concrete cone failure									
Effective anchorage depth	h_{ef}	[mm]	50,6			58,1			75,4
Characteristic edge distance	$c_{cr,N}$	[mm]	$1{,}5h_{ef}$						
Characteristic spacing	$s_{cr,N}$	[mm]	$3h_{ef}$						
Factor for cracked concrete	k_{cr}	[-]	7,7 [1)]						
Factor for uncracked concrete	k_{ucr}	[-]	11,0 [1)]						
Splitting failure									
Characteristic edge distance for splitting	$c_{cr,sp}$	[mm]	$1{,}5h_{ef}$						
Characteristic anchor spacing for splitting	$s_{cr,sp}$	[mm]	$3h_{ef}$						

1) Based on concrete strength measured on cylinders.
2) In absence of other national regulations.

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Betongskrue Op. 1	**Annex C1**
Performance Characteristic values under tension loading	

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Table C2: Characteristic resistance under tension loading (Stainless Steel A4)

Fastener size			**SK 8**			**SK 10**				**SK 12**
Head type			**H HF**	**CS**	**PH**	**H HF**	**HB**	**CS**	**PH**	**H HF**
Material			**Stainless steel A4**							
Steel failure										
Characteristic resistance	$N_{Rk,s}$	[kN]	33,0	22,3	22,3	53,7	53,7	36,2	36,2	78,1
Partial factor	γ_{Ms} [2)]	[-]	1,5			1,5				1,5
Pull-out failure										
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	4,5	4,5	4,0	7,0	7,0	7,0	7,0	12,0
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	9,0	5,5	4,0	16,0	16,0	10	7,0	25,0
Increasing factors for $N_{Rk,p}$ in cracked or uncracked concrete	ψ_c	C30/37	1,22							
		C40/50	1,41							
		C50/60	1,58							
Installation factor	γ_{inst}	[-]	1,4			1,0				1,2
Concrete cone failure										
Effective anchorage depth	h_{ef}	[mm]	51,9			58,7				75,6
Characteristic edge distance	$c_{cr,N}$	[mm]	$1{,}5h_{ef}$							
Characteristic spacing	$s_{cr,N}$	[mm]	$3h_{ef}$							
Factor for cracked concrete	k_{cr}	[-]	7,7 [1)]							
Factor for uncracked concrete	k_{ucr}	[-]	11,0 [1)]							
Splitting failure										
Characteristic edge distance for splitting	$c_{cr,sp}$	[mm]	$1{,}5h_{ef}$							
Characteristic anchor spacing for splitting	$s_{cr,sp}$	[mm]	$3h_{ef}$							

1) Based on concrete strength measured on cylinders.
2) In absence of other national regulations.

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Betongskrue Op. 1	**Annex C2**
Performance Characteristic values under tension loading	

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Table C3: Displacements under tension loads for non-cracked and cracked concrete

Fastener size	Material	Head type	Concrete	Tension load N	Displacement	
					δ_{N0}	$\delta_{N\infty}$
[-]	[-]	[-]	[-]	[kN]	[mm]	[mm]
SK 8	Steel 10B21	H/HF	cracked C20/25	1,5	0,1	0,8
		CS				
		PH				
SK 10		H/HF		4,8	0,2	1,0
		CS				
		PH				
SK 12		H/HF		4,8	0,3	1,2
SK 8	Stainless steel A4	H/HF	cracked C20/25	1,5	0,1	0,8
		CS		1,5		
		PH		1,4		
SK 10		H/HF/HB		3,3	0,2	1,0
		CS				
		PH				
SK 12		H/HF		4,8	0,3	1,2
SK 8	Steel 10B21	H/HF	uncracked C20/25	3,1	0,1	0,8
		CS				
		PH		2,2		
SK 10		H/HF		7,6	0,1	1,0
		CS				
		PH		5,2		
SK 12		H/HF		9,9	0,3	1,2
SK 8	Stainless steel A4	H/HF	uncracked C20/25	3,1	0,1	0,8
		CS		1,8		
		PH		1,4		
SK 10		H/HF/HB		7,6	0,1	1,0
		CS		4,8		
		PH		3,3		
SK 12		H/HF		9,9	0,3	1,2

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Betongskrue Op. 1	Annex C3
Performance Displacements under tension loading	

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Table C4: Characteristic resistance under shear loading

Fastener size			**SK 8**			**SK 10**			**SK 12**	
Head type			H HF CS PH	H HF	CS PH	H HF CS PH	H HF HB	CS PH	H HF	H HF
Material			10B21	A4		10B21	A4		10B21	A4
Setting depth	h_{nom}	[mm]	65	85		75	100		95	120
Effective embedment depth	h_{ef}	[mm]	50,6	51,9		58,1	58,7		75,4	75,6
Steel failure without lever arm										
Characteristic resistance	$V^0_{Rk,s}$	[kN]	16,9	16,5	11,2	26,8	26,8	18,1	39,0	39,0
Ductility factor	k_7	[-]	0,8							
Partial factor	γ_{Ms} [1)]	[-]	1,5	1,25		1,5	1,25		1,5	1,25
Steel failure with lever arm										
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	39,1	35,9	24,2	79,0	74,4	50,2	138,8	130.6
Partial factor	γ_{Ms} [1)]	[-]	1,5	1,25		1,5	1,25		1,5	1,25
Concrete pryout failure										
k-factor	k_8	[-]	1,0						2,0	
Partial factor	γ_{Mcp} [1)]	[-]	1,5							
Concrete edge failure										
Effective length of anchor	ℓ_f	[mm]	50,6	51,9		58,1	58,7		75,4	75,6
Outside diameter of fastener	d_{nom}	[mm]	7,25			9,24			11,15	
Partial factor	γ_{Mc} [1)]	[-]	1,5							

1) In absence of other national regulations.

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Betongskrue Op. 1	**Annex C4**
Performance Characteristic values under shear loading	

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Table C5: Displacements under shear loads for non-cracked and cracked concrete

Fastener size	Material	Head type	Concrete	Shear load V	Displacement	
					δ_{V0}	$\delta_{V\infty}$
[-]	[-]	[-]	[-]	[kN]	[mm]	[mm]
SK 8	Steel 10B21	H/HF	Cracked and uncracked C20/25	1,5	1,8	2,7
		CS				
		PH				
SK 10		H/HF		12,8		
		CS				
		PH				
SK 12		H/HF		18,6		
SK 8	Stainless steel A4	H/HF	Cracked and uncracked C20/25	9,4	1,8	2,7
		CS		6,4		
		PH				
SK 10		H/HF/HB		15,3		
		CS		10,3		
		PH				
SK 12		H/HF		22,3		

Betongskrue Op. 1	**Annex C5**
Performance Displacements under shear loading	

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Table C6: Characteristic tension resistance values for resistance to fire

Fastener size				**SK 8**			**SK 10**		**SK 12**	
Head type				H HF CS PH	H HF CS	PH	H HF CS PH	H HF HB CS PH	H HF	H/HF
Material				10B21	A4		10B21	A4	10B21	A4
Steel failure										
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	0,41	0,8		1,0	1,7	2,0	2,9
	R60	$N_{Rk,s,fi}$	[kN]	0,37	0,7		0,9	1,3	1,5	2,4
	R90	$N_{Rk,s,fi}$	[kN]	0,29	0,5		0,7	1,0	1,3	2,0
	R120	$N_{Rk,s,fi}$	[kN]	0,21	0,4		0,5	0,9	1,0	1,6
Pull-out failure										
Characteristic resistance in concrete ≥ C20/25	R30 R60 R90	$N_{Rk,p,fi}$	[kN]	1,1	1,1	1,0	2,5	1,8	3,0	3,0
	R120	$N_{Rk,p,fi}$	[kN]	0,9	0,9	0,8	2,0	1,4	2,4	2,4
Concrete cone failure										
Characteristic resistance in concrete ≥ C20/25	R30 R60 R90	$N^0_{Rk,c,fi}$	[kN]	3,1	3,3		4,4	4,5	8,5	8,6
	R120	$N^0_{Rk,c,fi}$	[kN]	2,5	2,7		3,5	3,6	6,8	6,8
Effective embedment depth		h_{ef}	[mm]	50,6	51,9		58,1	58,7	75,4	75,6
Minimum member thickness		h_{min}	[mm]	110	125		130	140	160	170
Spacing		$s_{cr,N,fi}$	[mm]	$4h_{ef}$						
		s_{min}	[mm]	50			60		70	
Edge distance		$c_{cr,N,fi}$	[mm]	$2h_{ef}$						
Fire exposure from one side only		c_{min}	[mm]	50			60		70	
Fire exposure from more than one side				≥ 300 mm						

1) In absence of other national regulations.

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Betongskrue Op. 1

Performance
Characteristic values for resistance to fire (tension)

Annex C6

Deutsches Institut für Bautechnik DIBt

Table C7: Characteristic shear resistance values for resistance to fire

Fastener size				**SK 8**		**SK 10**		**SK 12**	
Head type				all	all	all	all	all	all
Material				10B21	A4	10B21	A4	10B21	A4
Steel failure without level arm									
Characteristic resistance	R30	$V^0_{Rk,s,fi}$	[kN]	0,41	0,8	1,0	1,7	2,0	2,9
	R60	$V^0_{Rk,s,fi}$	[kN]	0,37	0,7	0,9	1,3	1,5	2,4
	R90	$V^0_{Rk,s,fi}$	[kN]	0,29	0,5	0,7	1,0	1,3	2,0
	R120	$V^0_{Rk,s,fi}$	[kN]	0,21	0,4	0,5	0,9	1,0	1,6
Steel failure with level arm									
Characteristic resistance	R30	$M^0_{Rk,p,fi}$	[Nm]	0,45	0,9	1,4	2,3	3,4	4,9
	R60	$M^0_{Rk,p,fi}$	[Nm]	0,40	0,7	1,2	1,9	2,5	4,0
	R90	$M^0_{Rk,p,fi}$	[Nm]	0,31	0,5	0,9	1,5	2,1	3,3
	R120	$M^0_{Rk,p,fi}$	[Nm]	0,22	0,45	0,7	1,3	1,6	2,6
Pry-out failure									
k_8			[-]	1		1		2	
Characteristic resistance	R30	$V^0_{Rk,cp,fi}$	[kN]	3,1	3,3	4,4	4,5	17,0	17,1
	R60								
	R90								
	R120	$V^0_{Rk,cp,fi}$	[kN]	2,5	2,7	3,5	3,6	13,6	13,7
Concrete edge failure									
Characteristic resistance	≤ R90	$V^0_{Rk,c,fi}$	[kN]	$V^0_{Rk,c,fi} = 0.25 * V^0_{Rk,c}$ [2)]					
	R120	$V^0_{Rk,c,fi}$	[kN]	$V^0_{Rk,c,fi} = 0.20 * V^0_{Rk,c}$ [2)]					

1) In absence of other national regulations.

2) $V^0_{Rk,c}$ = characteristic resistance for concrete edge failure in cracked concrete C20/C25 under normal temperature calculated acc. to EN 1992-4.

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Betongskrue Op. 1

Performance
Characteristic values for resistance to fire (shear)

Annex C7