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Designated according to Article 29 of Regulation (EU) No 305/2011

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European Technical Assessment

ETA 08/0173
of 28/02/2023

I General Part

Technical Assessment Body issuing the ETA	**Eurofins Expert Services Oy**
Trade name of the construction product	**Sormat through bolts S-KA, S-KAK, S-KAH, S-KAH HCR**
Product family to which the construction product belongs	Torque controlled expansion anchors of sizes M8, M10, M12 and M16 for use in concrete
Manufacturer	**EJOT Sormat Oy** Vähäkorventie 10 21250 Masku Finland www.ejot.fi
Manufacturing plant	EJOT Production Plants (Annex N)
This European Technical Assessment contains	14 pages including 11 annexes which form an integral part of this assessment. Separate Annex N
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	EAD 330232-01-0601
This ETA replaces	ETA 08/0173, issued on August 12, 2019

II Specific Part

1. Technical description of the product

The SORMAT through bolt S-KA is an anchor made of galvanized steel (designated as S-KA). The SORMAT through bolt S-KAK is an anchor made of hot dip galvanized steel (designated as S-KAK). The SORMAT through bolt S-KAH is an anchor made of stainless steel (designated as S-KAH). The SORMAT through bolt S-KAH HCR is an anchor made of high corrosion resistant stainless steel (designated as S-KAH HCR). The anchors are made in sizes M8, M10, M12 and M16. Anchors are placed into a drilled hole and anchored by torque-controlled expansion.

The illustration and description of the product are given in Annexes A.

2. Specification of the intended use in accordance with the applicable European Assessment Document, EAD

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

The provisions made in this European technical assessment are based on an assumed working life of the anchor 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 tension resistance for static and quasi-static action acc. EN 1992-4:2018	See Annex C1
Characteristic shear resistance for static and quasi-static action acc. EN 1992-4:2018	See Annex C2
Characteristic resistance for Seismic Performance Category C1	See Annex C6
Displacements under static and quasi-static action	See Annex C5

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Characteristic tension resistance under fire exposure	See Annex C3
Characteristic shear resistance under fire exposure	See Annex C4

3.3 Hygiene, health and the environment (BWR 3)

Regarding dangerous substances contained in this European technical assessment, there may be requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the regulation (EU) No 305/2011, these requirements need also to be complied with, when and where they apply.

3.4 Safety in use (BWR 4)

For basic requirement Safety in use the same criteria are valid for Basic Requirement Mechanical resistance and stability (BWR1).

3.5 Protection against noise (BWR5):

Not relevant.

3.6 Energy economy and heat retention (BWR6):

Not relevant.

3.7 Sustainable use of natural resources (BWR7)

The sustainable use of natural resources was not investigated.

3.8 General aspects relating to fitness for use

Durability and Serviceability are only ensured if the specifications of intended use according to Annex B1 are kept.

4. Assessment and verification of constancy of performance (AVCP)

According to the Decision 96/582/EC of the European Commission[1], as amended, the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is System 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 Assessment and verification of constancy of performance (AVCP) system are laid down in the control plan deposited at Eurofins Expert Services Oy.

Issued in Espoo on February 28, 2023
by Eurofins Expert Services Oy

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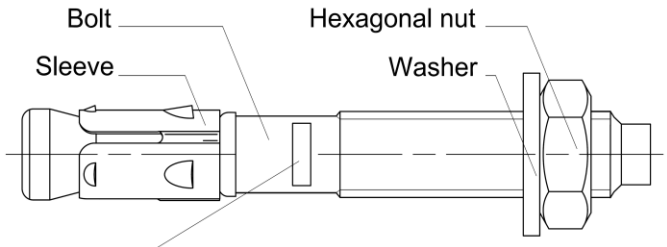
[1] Official Journal of the European Communities L 254 of 08.10.1996

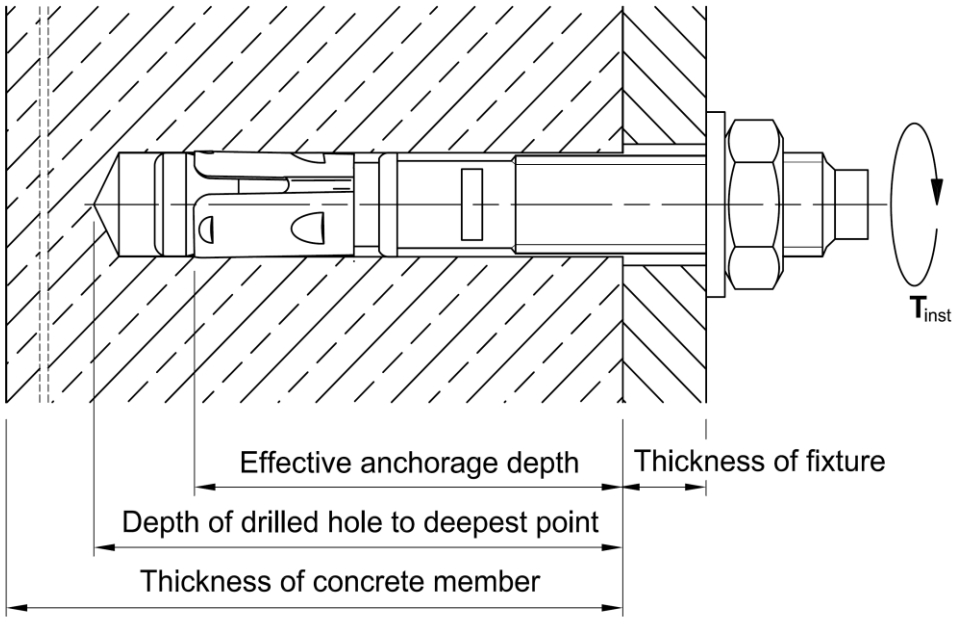
SORMAT through bolt



Marking:	Identifying mark:	S	
	Anchor identity:	KA	
	Category *[1)]:	H (stainless steel)	
		K (hot dip galvanized)	
	Thread size:	M8 … M16	
	Max. fixture thickness:	t_{fix}	
	Material *[1)]:	HCR	
	Examples:	S-KA 10/20	- zinc plated
		S-KAK 10/20	- hot dip galvanized
		S-KAH 10/20	- stainless steel A4
		S-KAH 10/20 HCR	- stainless steel HCR

*[1)] : Where applicable

SORMAT through bolt after installation



Sormat through bolt	
Product description Installation condition	**Annex A1**

SORMAT through bolt

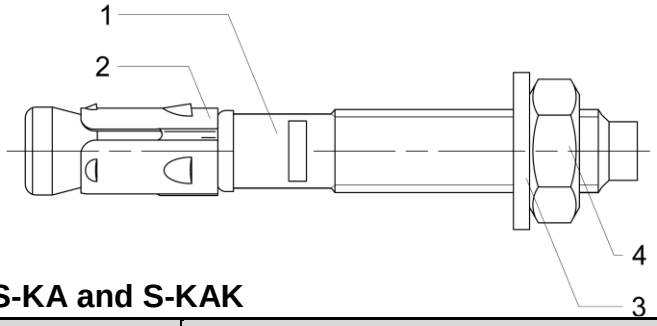


Table A1: Materials S-KA and S-KAK

Part	Designation	Diameter	Material [1) 2)]
1	Bolt	M8 - M16	Cold forged steel, EN 10263-2
2	Sleeve	M8 - M16	Cold rolled galvanized steel strip, EN 10346
3	Washer	M8 - M16	Electroplated steel, DIN 125 (EN ISO 7089), DIN 440 (EN ISO 7094), DIN 9021 (EN ISO 7093)
4	Hexagonal Nut	M8 - M16	Steel, electroplated, property class 8, DIN 934 (EN ISO 4032)

[1)] **S-KA:** Parts 1, 3 and 4 are zinc electroplated according to EN ISO 4042 ≥ 5 µm and bright passivated
[2)] **S-KAK:** Parts 1, 3 and 4 are hot dip galvanized > 50 µm mean thickness according to EN ISO 10684

Table A2: Materials S-KAH

Part	Designation	Diameters	Material
1	Bolt	M8 - M16	Cold forged stainless steel, EN 10088-3
2	Sleeve	M8 - M16	Stainless steel strip, EN 10088-2
3	Washer	M8 - M16	Stainless steel, DIN 125 (EN ISO 7089), DIN 440 (EN ISO 7094), DIN 9021 (EN ISO 7093)
4	Hexagonal Nut	M8 - M16	Stainless steel, property class 80, DIN 934 (EN ISO 4032)

Table A3: Materials S-KAH HCR

Part	Designation	Diameters	Material
1	Bolt	M8 - M16	Cold forged stainless steel, EN 10088-3, 1.4529 / 1.4565
2	Sleeve	M8 - M16	Stainless steel strip, EN 10088-2
3	Washer	M8 - M16	Stainless steel, W 1.4529 / 1.4565, DIN 125 (EN ISO 7089), DIN 440 (EN ISO 7094), DIN 9021 (EN ISO 7093)
4	Hexagonal Nut	M8 - M16	Stainless steel, property class 70, W 1.4529 / 1.4565 DIN 934 (EN ISO 4032)

Sormat through bolt	**Annex A2**
Product description Materials	

Specifications of intended use

Anchorages subject to:

- Static, quasi-static loads
- Seismic actions for Performance Category C1
- Fire exposure

Base materials:

- Cracked and non-cracked concrete
- Reinforced or unreinforced normal weight concrete of strength classes C20/25 to C50/60 according to EN 206.

Use conditions (Environmental conditions):

- The S-KA and S-KAK anchors may only be used in structures subject to dry indoor conditions, indoor with temporary condensation.
- The S-KAH anchors may be used in concrete subject to dry internal conditions and also in concrete subject to external atmospheric exposure (including industrial and marine environment), or exposure in permanently damp internal conditions, if no particular aggressive conditions exist.
- The S-KAH HCR anchors may be used in concrete subject to dry internal conditions and also in concrete subject to external atmospheric exposure, in permanently damp internal conditions or in other particular aggressive conditions.

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

Design:

- The anchorages are designed in accordance with EN 1992-4:2018 under the responsibility of an engineer experienced in anchorages and concrete work.
- For seismic application the anchorages are designed in accordance with EN 1992-4:2018.
- For application with resistance under fire exposure the anchorages are designed in accordance with EN 1992-4:2018.
- 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.

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor
- Anchor installation in accordance with the manufacturer's specifications and drawings and using the appropriate tools
- Effective anchorage depth, edge distances and spacings not less than the specified values without minus tolerances
- Hole drilling by hammer drill
- Cleaning of the hole of drilling dust
- Application of specified torque moment using a calibrated torque tool
- In case of aborted hole, drilling of new hole at a minimum distance of twice the depth of the aborted hole, or smaller distance provided the aborted drill hole is filled with high strength non-shrinkage mortar. No shear or oblique tension loads are allowed in the direction of a not filled aborted hole.

Sormat through bolt	
Intended Use Specifications	**Annex B1**

SORMAT through bolt

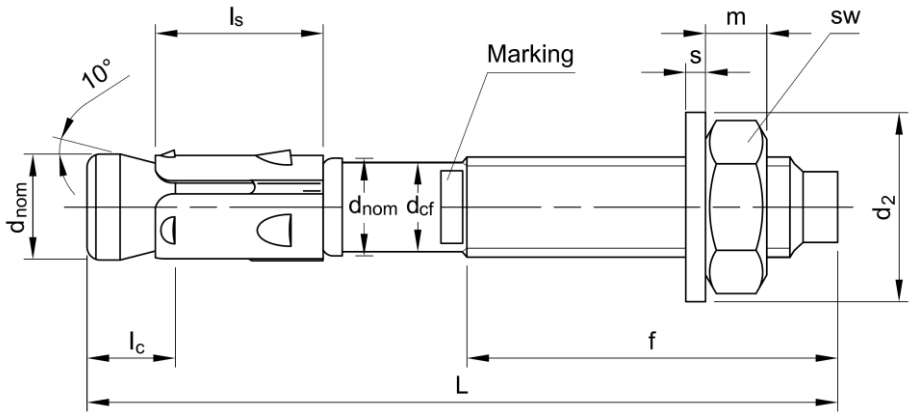


Table B1: Dimensions of the anchor

Main dimensions		Stud bolt		Cone bolt		Expansion sleeve	Washer			Hexagonal nut	
Size	**L** [mm]	**f** [mm]	**d_{cf}** [mm]	**d_{nom}** [mm]	**l_c** [mm]	**l_s** [mm]	**s** [mm]	**d_1** [mm]	**d_2** [mm]	**SW** [mm]	**m** [mm]
M8	62…420	22...220	7,1	8	20,9	15,9	≥1,6	≥8,4	≥16	13	≥6,5
M10	82…420	37…215	9,0	10	25,7	17,9	≥2,0	≥10,5	≥20	≥16	≥8,0
M12	98…420	48…210	10,8	12	30,3	19,1	≥2,5	≥13,0	≥24	≥18	≥10,0
M16	118..420	60…202	14,6	16	38,1	26,3	≥3,0	≥17,0	≥30	24	≥13,0

Sormat through bolt	
Intended Use Anchor dimensions	**Annex B2**

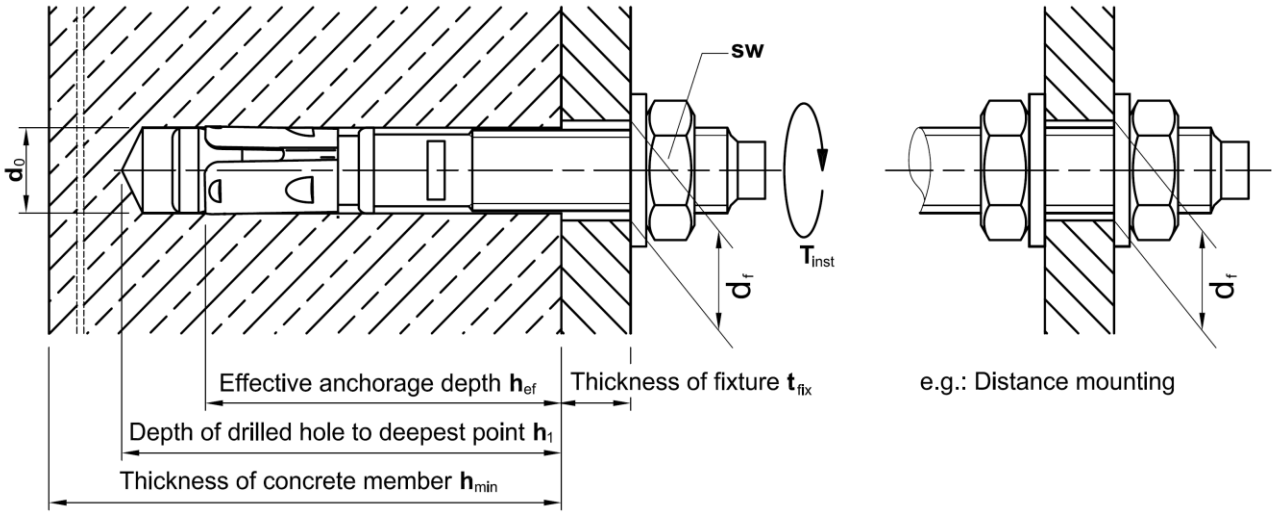


Table B2: Installation data

SORMAT through bolt			Anchor size			
			M8	M10	M12	M16
Drill hole diameter	d_0	[mm]	8	10	12	16
Cutting diameter at the upper tolerance limit (maximum diameter bit)	$d_{cut,max} \leq$	[mm]	8,45	10,45	12,5	16,5
Depth of drilled hole to deepest point	$h_1 \geq$	[mm]	60	75	90	110
Effective anchorage depth	h_{ef}	[mm]	45	60	70	85
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	9	12	14	18
Thickness of fixture	$t_{fix,max}$	[mm]	358	338	322	302
Width across flats	SW	[mm]	13	≥16	≥18	24
Required torque S-KA / S-KAK	T_{inst}	[Nm]	20 / 15 [1)]	35	50	120
Required torque S-KAH / S-KAH HCR	T_{inst}	[Nm]	20	35	70	120

[1)] Installation torque for S-KA is 20 Nm and for S-KAK 15 Nm

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

SORMAT through bolt			Anchor size			
			M8	M10	M12	M16
Minimum thickness of concrete member	h_{min}	[mm]	100	120	140	170
Minimum spacing	s_{min}	[mm]	50	55	60	70
	$c \geq$	[mm]	50	80	90	120
Minimum edge distance	c_{min}	[mm]	50	50	55	85
	$s \geq$	[mm]	50	100	145	150

Intervalues may be interpolated linearly

Sormat through bolt	Annex B3
Intended Use Installation data	

Table C1: Characteristic resistances under tension loads in case of static and quasi-static loading for design according to EN 1992-4:2018

SORMAT through bolt			Anchor size			
			M8	M10	M12	M16
Steel failure						
Characteristic resistance S-KA / S-KAK	$N_{Rk,s}$	[kN]	13	26	38	69
Characteristic resistance S-KAH / S-KAH HCR	$N_{Rk,s}$	[kN]	15	24	35	75
Partial safety factor	γ_{Ms} 1)	[-]	1,4			
Pull-out failure						
Characteristic resistance in **cracked** concrete C20/25	$N_{Rk,p}$	[kN]	5	9	12	20
Characteristic resistance in **non-cracked** concrete C20/25	$N_{Rk,p}$	[kN]	9	16	20	35
Increasing factor for $N_{Rk,p}$	Ψ_C	C25/30	1,06			
		C30/37	1,11			
		C35/45	1,14			
		C40/50	1,20			
		C45/55	1,25			
		C50/60	1,31			
Partial safety factor	γ_{inst} 1)	[-]	1,2			1,0
	γ_{Mp}	[-]	1,8 2)			1,5 3)
Concrete cone and splitting failure						
Effective anchorage depth	h_{ef}	[mm]	45	60	70	85
Factor for cracked concrete	k_{cr}	[-]	7,7			
Factor for non-cracked concrete	k_{ucr}	[-]	11,0			
Spacing	$s_{cr,N}$	[mm]	135	180	210	255
Edge distance	$c_{cr,N}$	[mm]	68	90	105	128
Spacing (splitting)	$s_{cr,sp}$	[mm]	180	240	280	340
Edge distance (splitting)	$c_{cr,sp}$	[mm]	90	120	140	170
Partial safety factor	γ_{inst} 1)	[-]	1,2			1,0
	γ_{Mc} γ_{Msp}	[-]	1,8 2)			1,5 3)

1) In absence of other national regulations
2) The installation safety factor of γ_{inst} = 1,2 is included
3) The installation safety factor of γ_{inst} = 1,0 is included

Sormat through bolt	
Performance Characteristic resistance under tension loads	**Annex C1**

Table C2: Characteristic resistances under shear loads in case of static and quasi-static loading for design according to EN 1992-4:2018

SORMAT through bolt			Anchor size			
			M8	M10	M12	M16
Steel failure without lever arm						
Characteristic resistance S-KA / S-KAK	$V_{Rk,s}$	[kN]	10	18	23	44
Characteristic resistance S-KAH / S-KAH HCR	$V_{Rk,s}$	[kN]	11	17	25	47
Partial safety factor	γ_{Ms} 1)	[-]	1,25			
Factor for considering ductility	k_7	[-]	1,0			
Steel failure with lever arm						
Characteristic resistance S-KA / S-KAK	$M^0_{Rk,s}$	[Nm]	21	48	72	186
Characteristic resistance S-KAH / S-KAH HCR	$M^0_{Rk,s}$	[Nm]	22	45	79	200
Partial safety factor	γ_{Ms} 1)	[-]	1,25			
Concrete pryout failure						
k-factor	k_8	[-]	1	2		
Partial safety factor	γ_{Mc} 1)	[-]	1,5			
Concrete edge failure						
Effective length of anchor under shear load	l_f	[mm]	45	60	70	85
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16
Cracked concrete without any edge reinforcement	$\Psi_{re,V}$	[-]	1,0			
Cracked concrete with straight edge reinforcement > Ø12 mm			1,2			
Cracked concrete with edge reinforcement and closely spaced stirrups (a ≤ 100mm) or **non-cracked concrete**			1,4			
Partial safety factor	γ_{Mc} 1)	[-]	1,5			

1) In absence of other national regulations

Sormat through bolt	
Performance Characteristic resistance under shear loads	**Annex C2**

Table C3: Characteristic resistances under tension loads in case of fire exposure for design according to EN 1992-4:2018

Sormat through bolt				Anchor size			
				M8	M10	M12	M16
Steel failure							
Characteristic resistance $N_{Rk,s,fi}$	S-KA / S-KAK	R30	[kN]	1,3	2,3	3,6	5,3
		R60	[kN]	0,7	1,3	2,0	3,0
		R90	[kN]	0,4	0,8	1,3	1,8
		R120	[kN]	0,3	0,5	0,9	1,3
	S-KAH / S-KAH HCR	R30	[kN]	5,7	9,1	13,2	24,5
		R60	[kN]	3,9	6,1	8,9	16,6
		R90	[kN]	2,0	3,2	4,7	8,7
		R120	[kN]	1,1	1,8	2,6	4,8
Pull-out failure							
Characteristic resistance $N_{Rk,p,fi}$	S-KA / S-KAK	R30	[kN]	1,3	2,3	3,0	5,0
		R60	[kN]	1,3	2,3	3,0	5,0
		R90	[kN]	1,3	2,3	3,0	5,0
		R120	[kN]	1,0	1,8	2,4	4,0
Characteristic resistance $N_{Rk,p,fi}$	S-KAH / S-KAH HCR	R30	[kN]	1,3	2,3	3,0	5,0
		R60	[kN]	1,3	2,3	3,0	5,0
		R90	[kN]	1,3	2,3	3,0	5,0
		R120	[kN]	1,0	1,8	2,4	4,0
Concrete cone and splitting failure [1)]							
Characteristic resistance $N^0_{Rk,c,fi}$		R30	[kN]	2,4	5,0	7,4	12,0
		R60	[kN]	2,4	5,0	7,4	12,0
		R90	[kN]	2,4	5,0	7,4	12,0
		R120	[kN]	2,0	4,0	5,9	9,6
Spacing		$s_{cr,N,fi}$	[mm]	$4 \times h_{ef}$			
		s_{min}	[mm]	50	55	60	70
Edge distance		$c_{cr,N,fi}$	[mm]	$2 \times h_{ef}$			
		c_{min}	[mm]	Fire attack from one side: $c_{min} = 2 \times h_{ef}$			
				Fire attack from more than one side: $c_{min} \geq 300$ mm and $\geq 2 \times h_{ef}$			

1) As a rule, splitting failure can be neglected when cracked concrete and reinforcement is assumed

Design under fire exposure is performed according to EN 1992-4:2018.
Under fire exposure usually cracked concrete is assumed. The design equations are given in EN 1992-4:2018.

In the absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended.

Sormat through bolt	
Performance Characteristic tension resistance under fire exposure	**Annex C3**

Table C4: Characteristic resistances under shear loads in case of fire exposure for design according to EN 1992-4:2018

Sormat through bolt				Anchor size			
				M8	M10	M12	M16
Steel failure without lever arm							
Characteristic resistance $V_{Rk,s,fi}$	S-KA / S-KAK	R30	[kN]	1,3	2,3	3,6	5,3
		R60	[kN]	0,7	1,3	2,0	3,0
		R90	[kN]	0,4	0,8	1,3	1,8
		R120	[kN]	0,3	0,5	0,9	1,3
	S-KAH / S-KAH HCR	R30	[kN]	5,7	9,1	13,2	24,5
		R60	[kN]	3,9	6,1	8,9	16,6
		R90	[kN]	2,0	3,2	4,7	8,7
		R120	[kN]	1,1	1,8	2,6	4,8
Steel failure with lever arm							
Characteristic resistance $M^0_{Rk,s,fi}$	S-KA / S-KAK	R30	[Nm]	1,8	3,6	6,4	16,2
		R60	[Nm]	1,3	2,6	4,6	11,7
		R90	[Nm]	0,8	1,6	2,8	7,2
		R120	[Nm]	0,6	1,1	1,9	4,9
	S-KAH / S-KAH HCR	R30	[Nm]	5,8	11,7	20,4	52,0
		R60	[Nm]	4,0	7,9	13,9	35,2
		R90	[Nm]	2,1	4,2	7,3	18,5
		R120	[Nm]	1,1	2,3	4,0	10,2
Concrete pryout failure							
k-factor		k_8	[-]	1	2		
Characteristic resistance $V_{Rk,cp,fi}$		R30	[kN]	2,4	10,0	14,8	24,0
		R60	[kN]	2,4	10,0	14,8	24,0
		R90	[kN]	2,4	10,0	14,8	24,0
		R120	[kN]	2,0	8,0	11,8	19,2
Concrete edge failure							
The initial value $V^0_{Rk,c,fi}$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: $V^0_{Rk,c,fi} = 0,25 \times V^0_{Rk,c}$ (≤ R90) $V^0_{Rk,c,fi} = 0,20 \times V^0_{Rk,c}$ (R120) with $V^0_{Rk,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature.							

Design under fire exposure is performed according to EN 1992-4:2018.

Under fire exposure usually cracked concrete is assumed. The design equations are given in EN 1992-4:2018.

EN 1992-4:2018 covers design for fire exposure from one side. For fire attack from more than one side the edge distance must be increased to $c_{min} \geq 300$ mm and $\geq 2 \times h_{ef}$.

In the absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended.

Sormat through bolt	
Performance Characteristic shear resistance under fire exposure	**Annex C4**

Table C5: Displacements under tension loads for static and quasi-static loading

SORMAT through bolt			Anchor size			
			M8	M10	M12	M16
Cracked and non-cracked concrete C20/25 - C50/60	N	[kN]	2,0	3,6	4,8	9,5
	δ_{N0}	[mm]	0,3	0,6	0,6	0,7
	$\delta_{N\infty}$	[mm]	1,8	1,6	2,0	1,4

Table C6: Displacements under shear loads for static and quasi-static loading

SORMAT through bolt			Anchor size			
			M8	M10	M12	M16
Cracked and non-cracked concrete C20/25 - C50/60	V	[kN]	5,7	10,3	13,1	25,1
	δ_{V0}	[mm]	1,7	1,7	2,4	3,2
	$\delta_{V\infty}$	[mm]	2,6	2,6	3,6	4,8

Sormat through bolt

Performance

Displacements under tension and shear loads

Annex C5

Table C7: Characteristic resistances under tension loads in case of seismic action Design acc. EN 1992-4:2018: Performance Category C1

SORMAT through bolt			Anchor size			
			M8	M10	M12	M16
Steel failure						
Characteristic resistance S-KA	$N_{Rk,s,seis}$	[kN]	13	26	38	69
Characteristic resistance S-KAH	$N_{Rk,s,seis}$	[kN]	15	24	35	75
Partial safety factor	$\gamma_{Ms,seis}$ 1)	[-]	1,4			
Pull-out failure						
Characteristic resistance in **cracked** concrete C20/25	$N_{Rk,p,seis}$	[kN]	5	9	12	20
Partial safety factor	$\gamma_{Mp,seis}$ 1)	[-]	1,8 2)			1,5 3)
Concrete cone and splitting failure 4)						
Effective anchorage depth	h_{ef}	[mm]	45	60	70	85
Partial safety factor	$\gamma_{Mc,seis}$ 1) $\gamma_{Msp,seis}$ 1)	[-]	1,8 2)			1,5 3)

1) In absence of other national regulations
2) The installation safety factor of γ_{inst} = 1,2 is included
3) The installation safety factor of γ_{inst} = 1,0 is included
4) For concrete cone and splitting failure, see EN 1992-4:2018

Table C8: Characteristic resistances under shear loads in case of seismic action Design acc. EN 1992-4:2018: Performance Category C1

SORMAT through bolt			Anchor size			
			M8	M10	M12	M16
Steel failure without lever arm						
Characteristic resistance S-KA	$V_{Rk,s,seis}$	[kN]	5,6	11,9	15,4	31,2
Characteristic resistance S-KAH	$V_{Rk,s,seis}$	[kN]	8,7	11,2	18,3	31,5
Partial safety factor	$\gamma_{Ms,seis}$ 1)	[-]	1,25			
Concrete pryout and concrete edge failure 2)						
Effective anchorage depth	h_{ef}	[mm]	45	60	70	85
Partial safety factor	$\gamma_{Mc,seis}$ 1)	[-]	1,5			

1) In absence of other national regulations
2) For concrete pryout and edge failure, see EN 1992-4:2018

Sormat through bolt

Performance

Characteristic tension and shear resistances under seismic action, Performance Category C1

Annex C6