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

Member of EOTA
www.eota.eu

European Technical Assessment ETA-08/0173 of 10/06/2016

GENERAL PART

TECHNICAL ASSESSMENT BODY ISSUING THE ETA AND DESIGNATED ACCORDING TO ARTICLE 29 OF THE REGULATION (EU) NO 305/2011	VTT EXPERT SERVICES LTD
TRADE NAME OF THE CONSTRUCTION PRODUCT	SORMAT THROUGH BOLTS S-KA, S-KAK, S-KAH, AND 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	SORMAT OY HARJUTIE 5 FIN-21290 RUSKO FINLAND www.sormat.com
MANUFACTURING PLANT	SORMAT PLANT 1
THIS EUROPEAN TECHNICAL ASSESSMENT CONTAINS	14 PAGES INCLUDING 11 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	GUIDELINES FOR EUROPEAN TECHNICAL APPROVAL ETAG 001 METAL ANCHORS FOR USE IN CONCRETE PART 1 AND PART 2, APRIL 2013, USED AS EUROPEAN ASSESSMENT DOCUMENT (EAD).
THIS VERSION REPLACES	EUROPEAN TECHNICAL ASSESSMENT ETA-08/0173 from 23/05/2014

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 the description of the product are given in Annexes A.

2. Specification of the intended uses 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 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. ETAG 001, Annex C or CEN/TS 1992-4:2009	See Annex C1
Characteristic shear resistance for static and quasi static action acc. ETAG 001, Annex C or CEN/TS 1992-4:2009	See Annex C2
Characteristic resistance for Seismic Performance Categories 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 Construction Products Directive, 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)

No performance determined.

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 Commission1, as amended, the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table apply.

Product	Intended use	Level or Class	System
Metal anchors for use in concrete	For fixing and/or supporting to concrete, structural elements (which contributes to the stability of the works) or heavy units	—	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 VTT Expert Services Ltd.

The manufacturer shall, on the basis of a contract, involve a notified body approved in the field of anchors for issuing the certificate of conformity CE based on the control plan.

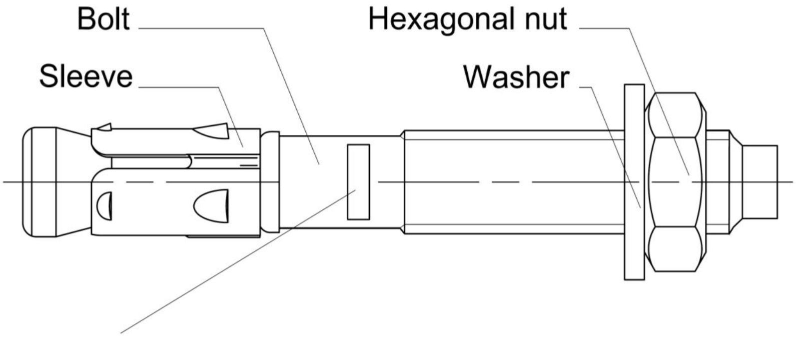
Issued in Espoo on June 10, 2016
by VTT Expert Services Ltd

Tiina Ala-Outinen
Business Manager

Pertti Jokinen
Product Manager

1 Official Journal of the European Communities L 254 of 08.10.1996

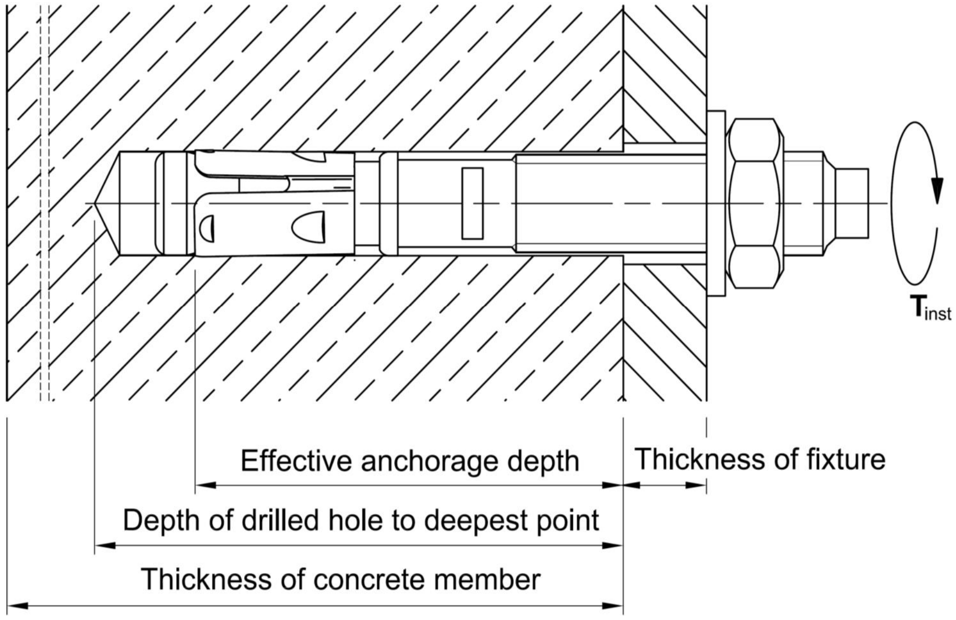
SORMAT through bolt



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	Annex A1
Product description Installation condition	

SORMAT through bolt

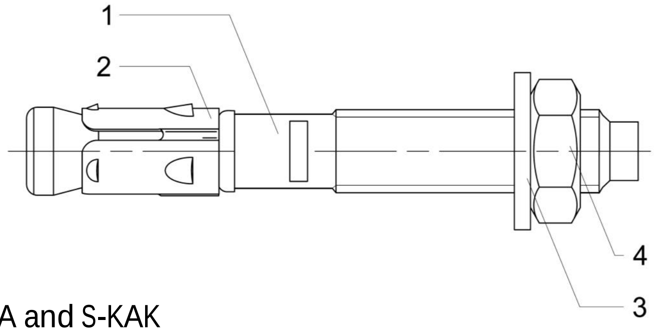


Table A1: Materials S-KA and S-KAK

Part	Designation	Diameter	Material [1) 2)]	f_{yk} [N/mm²]	f_{uk} N/mm²]
1	Bolt	M10 + M12	Cold forged steel, EN 10263-2	560	660
		M8 + M16		475	560
2	Sleeve	M8 - M16	Cold rolled galvanized steel strip, EN 10147		
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 ≥ 5µm and bright passivated
[2)] S-KAK: Parts 1, 3 and 4 are hot dip galvanized according to EN ISO 10684

Table A2: Materials S-KAH

Part	Designation	Diameters	Material	f_{yk} [N/mm²]	f_{uk} [N/mm²]
1	Bolt	M8 - M16	Cold forged stainless steel, EN 10088-3	530	600
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	f_{yk} [N/mm²]	f_{uk} [N/mm²]
1	Bolt	M8 - M16	Cold forged stainl. steel, EN 10088-3 1.4529 / 1.4565	530	600
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
- Loads under fire exposure

Base materials:

- Cracked and non-cracked concrete
- Reinforced or unreinforced normal weight concrete of strength classes C 20/25 at least to C50/60 at most according to EN 206: 2013

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 the ETAG001 Annex C “Design Method for Anchorages” or CEN/TS 1992-4-4 "Design of fastenings for use in concrete” under the responsibility of an engineer experienced in anchorages and concrete work.
- For seismic application the anchorages are designed in accordance with EOTA TR045 “Design of Metal Anchors For Use In Concrete Under Seismic Actions”.
- For application with resistance under fire exposure the anchorages are designed in accordance with the method given in TR020 “Evaluation of Anchorage in Concrete concerning Resistance to Fire”.
- 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 mortar and no shear or oblique tension loads in the direction of aborted hole.

SORMAT through bolt

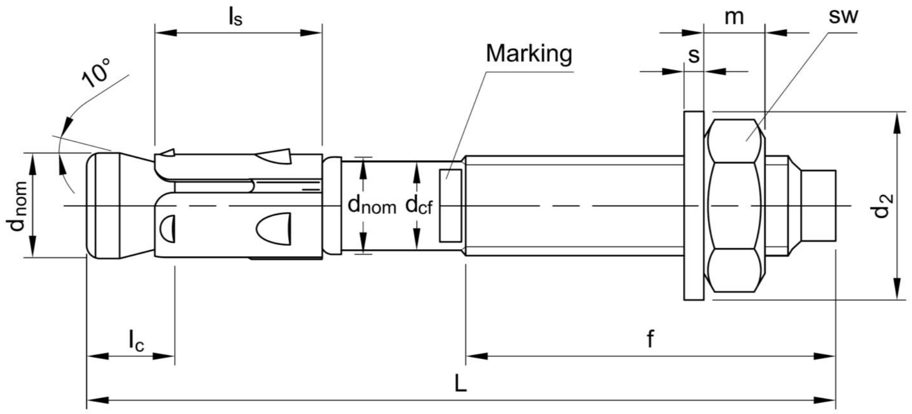


Table B1: Dimensions of the anchor

Main dimensions			Stud bolt		Cone bolt		Expansion sleeve	Washer			Hexagonal nut	
Anchor type	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]
8 / 0...358	M8	62...420	22...220	7,1	8	20,9	15,9	≥1,6	≥8,4	≥16	13	≥6,5
10 / 0...338	M10	82...420	37...215	9,0	10	25,7	17,9	≥2,0	≥10,5	≥20	≥16	≥8,0
12 / 0...322	M12	98...420	48...210	10,8	12	30,3	19,1	≥2,5	≥13,0	≥24	≥18	≥10,0
16 / 0...302	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

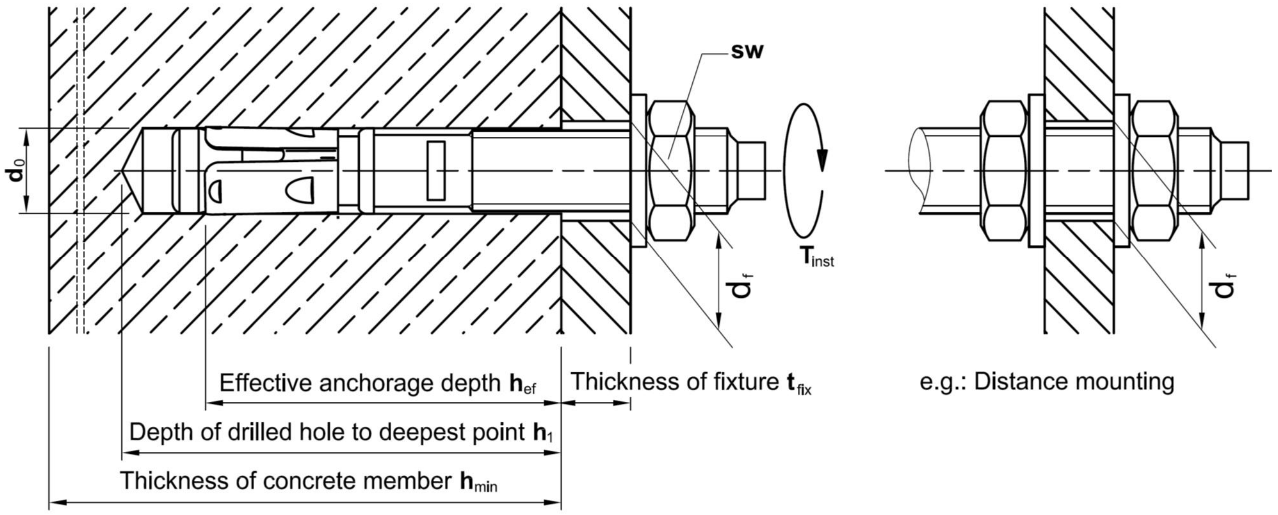


Table B2: Installation data

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	$t_{fix,min...max}$	[mm]	0...358	0...338	0...322	0...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 dege 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 method A according to ETAG 001, Annex C or CEN/TS 1992-4

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)	[-]	1,40			
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	1,04			
		C30/37	1,10			
		C35/45	1,16			
		C40/50	1,20			
		C45/55	1,24			
		C50/60	1,28			
Partial safety factor	γ_{Mp} 1)	[-]	1,80 2)			1,50 3)
Concrete cone and splitting failure						
Effective anchorage depth	h_{ef}	[mm]	45	60	70	85
Factor for cracked concrete	k_{cr}	[-]	7,2			
Factor for non-cracked concrete	k_{cr}	[-]	10,1			
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_{Msp} 1)	[-]	1,80 2)			1,50 3)

1) In absence of other national regulations
2) The installation safety factor of $\gamma_2 = 1,2$ is included
3) The installation safety factor of $\gamma_2 = 1,0$ is included

Table C2: Characteristic resistances under shear loads in case of static and quasi static loading for design method A according to ETAG 001, Annex C or CEN/TS 1992-4

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)	[-]	1,50			
Factor for considering ductility	k_2	[-]	1,00			
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)	[-]	1,50			
Concrete pryout failure						
k-factor	$k_{(3)}$	[-]	1	2		
Partial safety factor	γ_{Mc} 1)	[-]	1,50			
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	$\Psi_{ucr,V}$	[-]	1,00			
Cracked concrete with straight edge reinforcement > Ø12 mm	$\Psi_{ucr,V}$	[-]	1,20			
Cracked concrete with edge reinforcement and closely spaced stirrups (a ≤ 100mm) or non-cracked concrete	$\Psi_{ucr,V}$	[-]	1,40			
Partial safety factor	γ_{Mc} 1)	[-]	1,50			

1) In absence of other national regulations

Sormat through bolt	Annex C2
Performance Characteristic resistance under shear loads	

Table C3: Characteristic resistances under tension loads in case of fire exposure for design method A according to TR020 and ETAG 001, Annex C or CEN/TS 1992-4

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 $N_{Rk,c,fi}$		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 x h_{ef}			
		s_{min}	[mm]	50	55	60	70
Edge distance		$c_{cr,N,fi}$	[mm]	2 x h_{ef}			
		c_{min}	[mm]	Fire attack from one side: c_{min} = 2 x h_{ef}			
				Fire attack from more than one side: $c_{min} \geq 300$ mm and ≥ 2 x 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 the design method given in TR 020.
Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020 § 2.2.1.

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	Annex C3
Performance Characteristic tension resistance under fire exposure	

Table C4: Characteristic resistances under shear loads in case of fire exposure for design method A according to TR020 and ETAG 001, Annex C or CEN/TS 1992-4

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		$k_{(3)}$	[-]	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:

$$V^0_{Rk,c,fi} = 0,25 \times V^0_{Rk,c} \quad (\leq R90) \qquad V^0_{Rk,c,fi} = 0,20 \times V^0_{Rk,c} \quad (R120)$$

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 the design method given in TR 020.

Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020 § 2.2.1.

TR 020 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 $\geq 2 \cdot h_{ef}$.

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	Annex C4
Performance Characteristic shear resistance under fire exposure	

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

Table C7: Characteristic resistances under tension loads in case of seismic action
Design acc. TR045: 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)	[-]	1,40			
Pull-out failure						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p,seis}$	[kN]	5	9	12	20
Partial safety factor	γ_{Mp} 1)	[-]	1,80 2)			1,50 3)
Concrete cone and splitting failure 4)						
Effective anchorage depth	h_{ef}	[mm]	45	60	70	85
Partial safety factor	γ_{Msp} 1)	[-]	1,80 2)			1,50 3)

1) In absence of other national regulations
2) The installation safety factor of γ_2 = 1,2 is included
3) The installation safety factor of γ_2 = 1,0 is included
4) For concrete cone and splitting failure, see TR045

Table C8: Characteristic resistances under shear loads in case of seismic action
Design acc. TR045: 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)	[-]	1,50			
Concrete pryout and edge failure 2)						
Effective anchorage depth	h_{ef}	[mm]	45	60	70	85
Partial safety factor	$\gamma_{Mc,seis}$ 1)	[-]	1,50			

1) In absence of other national regulations
2) For concrete pryout and edge failure, see TR045

Sormat through bolt	Annex C6
Performance Characteristic tension and shear resistances under seismic action, Performance Category C1	