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European Technical Assessment

ETA-18/0971
of 21.08.2019

English version prepared by ZAG

General Part

Technical Assessment Body issuing the European Technical Assessment	**ZAG Ljubljana**
Trade name of the construction product	**Sormat through bolts S-KA/ S-KAK/ S-KAH**
Product family to which the construction product belongs	**33: Torque controlled expansion anchor of size M6 and M8 for multiple use for non-structural applications in concrete**
Manufacturer	**SORMAT OY** **Harjutie 5** **21290 RUSKO** **Finland** www.sormat.com
Manufacturing plant(s)	**Sormat Plant 1**
This European Technical Assessment contains	14 pages including 11 annexes, which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330747-00-0601: Fasteners for use in concrete for redundant non-structural systems, edition May 2018

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Specific parts

1 Technical description of the product

Sormat through bolts S-KA/ S-KAK/ S-KAH are made of zinc plated carbon steel (S-KA), hot dip galvanised carbon steel (S-KAK) or stainless steel (S-KAH). It consists of a bolt, expansion sleeve, hexagonal nut and washer.

Anchors are made in sizes M6 and M8. Anchor is placed into a drilled hole and anchored by torque-controlled expansion.

For the installed anchor see Figure given in Annex A1.

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

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

The provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, 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)

The basic work requirements for mechanical resistance and stability are listed in Annexes C1 and C2.

3.2 Safety in case of fire (BWR 2)

The basic work requirements for safety in case of fire are listed in Annexes C3 and C4.

3.3 Hygiene, health and 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. transported European legislation and national laws, regulations and administrative provisions). In order to meet provisions of the regulation (EU) No 305/2011, these requirements need also to be complied with, when they apply.

3.4 Safety in use (BWR 4)

For basic work requirement safety in use the same criteria are valid as for basic work requirement mechanical resistance and stability.

3.5 Protection against noise (BWR 5)

Not relevant.

3.6 Energy economy and heat retention (BWR 6)

Not relevant.

3.7 Sustainable use of natural resources (BWR 7)

No performance assessed.

3.8 General aspects relating to fitness for use

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

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

According to the decision 96/582/EC of the European Commission[1] the system of assessment and verification of constancy of performance (see Annex V to regulation (EU) No 305/2011) 2+ apply.

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

Technical details necessary for the implementation of the AVCP system are laid down in Chapter 3 of EAD 330747-00-0601.

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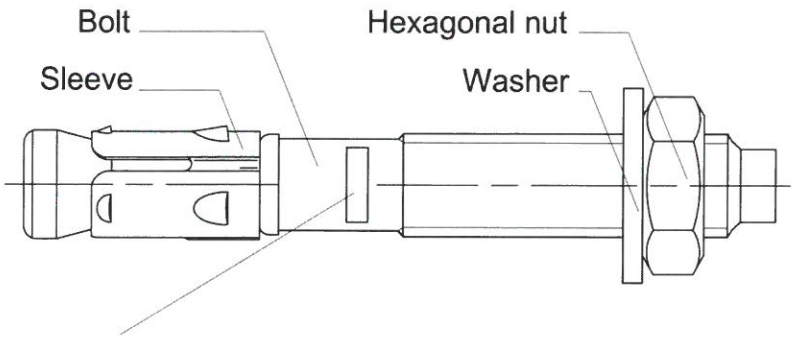
Signed by:

Franc Capuder, M.Sc.

Head of Service of TAB

[1] Official Journal of the European Communities L 254 of 8.10.1996

SORMAT through bolt



Marking (Optional):

S-KA:	S-KA M…/$t_{fix,max}$	- zinc plated
S-KA:	S-KA M… × length	- zinc plated
S-KAK:	S-KAK M…/$t_{fix,max}$	- hot dip galvanized
S-KAK:	S-KAK M… × length	- hot dip galvanized
S-KAH:	S-KAH M…/$t_{fix,max}$	- stainless steel A4
S-KAH:	S-KAH M… × length	- stainless steel A4

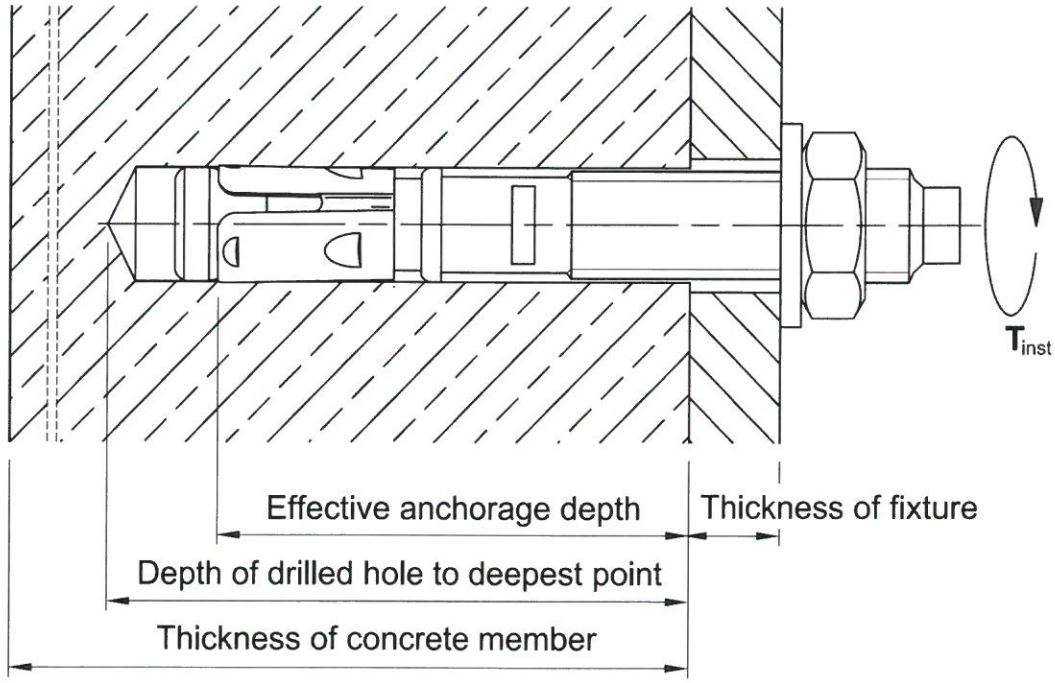
Examples:

S-KA 6/15	- zinc plated
S-KAK 6/15	- hot dip galvanized
S-KAH 6/15	- stainless steel

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Sormat through bolts S-KA/S-KAK/S-KAH	**Annex A1**
Product description Product	

SORMAT through bolt after installation



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Sormat through bolts S-KA/S-KAK/S-KAH	Annex A2
Product description Installation condition	

SORMAT through bolt

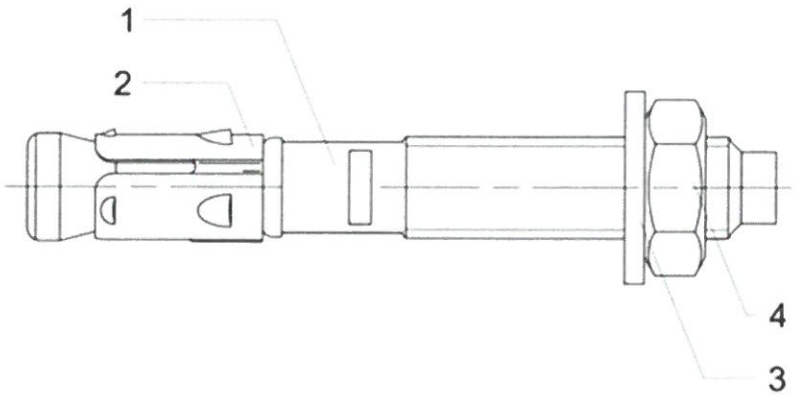


Table A1: Materials for S-KA and S-KAK

Part	Designation	Material [1) 2)]
1	Bolt	Cold forged steel
2	Sleeve	Cold rolled galvanized steel strip, EN 10346
3	Washer	Steel, DIN 125 (EN ISO 7089), DIN 440 (EN ISO 7094), DIN 9021 (EN ISO 7093)
4	Hexagonal nut	Steel, 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, EN ISO 1461

Table A2: Materials for S-KAH

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

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Sormat through bolts S-KA/S-KAK/S-KAH	Annex A3
Product description Materials	

Specifications of intended use

Anchorages subjected to:

- Static, quasi static load.
- Use only for multiple use for non-structural applications according to EAD 330747-00-0601
- Fire exposure.

Base materials:

- Cracked and non-cracked concrete.
- Reinforced and unreinforced normal weight concrete of strength class C20/25 at minimum and C50/60 at maximum according to EN 206:2013A1:2016.

Use conditions (Environmental conditions):

- The S-KA and S-KAK and S-KAH M6-1 anchors may be used in concrete subject to dry internal conditions.
- The S-KAH M6-2 and S-KAH M8 anchors may be used 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.

  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. 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.
- Anchorages under static and quasi-static actions are designed in accordance with EOTA TR 055, Edition December 2016, Amended February 2018 or EN 1992-4:2018.
- For application with resistance under fire exposure the anchorages are designed in accordance with the method given in EOTA TR 020, Edition May 2004.
- Verifiable calculation notes and drawings are prepared taking into account of the load 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.).

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters on 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 using the appropriate tools.
- Checks before placing the anchor to ensure that the strength class of the concrete in which the anchor is to be placed is in the range given and is not lower that of the concrete to which the characteristic loads apply for.
- Check of concrete being well compacted, e.g. without significant voids.
- Cleaning of the hole of drilling dust.
- Anchor installation ensuring the specified embedment depth.
- Keeping of the edge distance and spacing to the specified values without minus tolerances.
- 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.
- Application of the torque moment given in Annex B3 using a calibrated torque wrench.

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Sormat through bolts S-KA/S-KAK/S-KAH	Annex B1
Intended use Specifications	

SORMAT through bolt

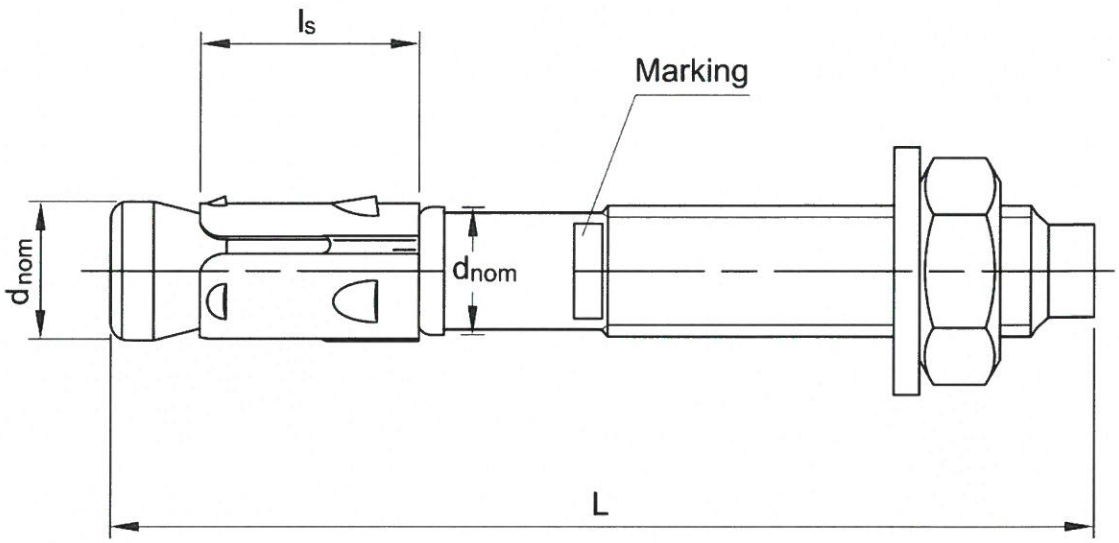


Table B1: Dimension of an anchor

Size	Nominal diameter d_{nom} [mm]	Sleeve length l_s [mm]	Total length L [mm]
M6	6	14,5	38 ... 420
M8	8	15,9	50 ... 420

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Sormat through bolts S-KA/S-KAK/S-KAH	Annex B2
Intended use Anchor dimensions	

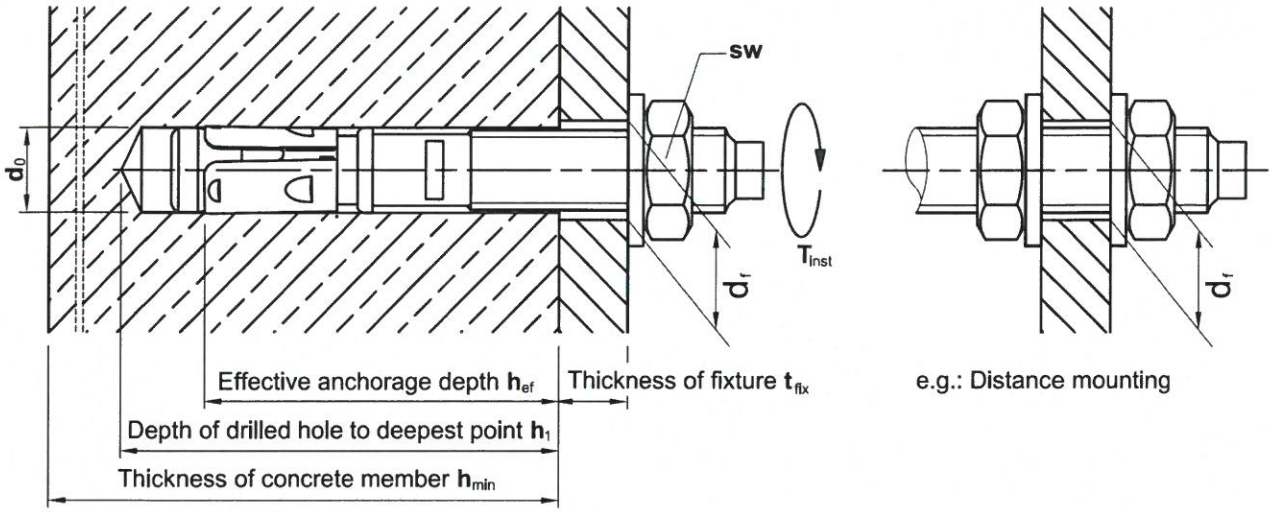


Table B2: Installation data

Sormat through bolts S-KA/S-KAK/S-KAH				Anchor size		
				M6-1	M6-2	M8
Drill hole diameter		d_0	[mm]	6	6	8
Cutting diameter at the upper tolerance limit (maximum diameter bit)		$d_{cut,max} \leq$	[mm]	6,40	6,40	8,45
Depth of drilled hole to deepest point		$h_1 \geq$	[mm]	35	45	45
Effective anchorage depth		h_{ef}	[mm]	25	35	35
Diameter of clearance hole in the fixture		$d_f \leq$	[mm]	7	7	9
Thickness of the fixture		$t_{fix,max}$	[mm]	380	370	370
Width across flats		SW	[mm]	10	10	13
Required torque	S-KA	T_{inst}	[Nm]	4	7	11
	S-KAK			4	7	15
	S-KAH			5	8	15

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Sormat through bolts S-KA/S-KAK/S-KAH	Annex B3
Intended use Installation data	

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

Sormat through bolts S-KA/S-KAK/S-KAH			Anchor size		
			M6-1	M6-2	M8
Minimum thickness of concrete member	h_{min}	[mm]	80	80	80
Minimum spacing	s_{min}	[mm]	50	40	60
Minimum edge distance	c_{min}	[mm]	50	40	60

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Sormat through bolts S-KA/S-KAK/S-KAH	Annex B4
Intended use Installation data	

Table C1: Characteristic resistances under tension loads in case of static and quasi-static loading for design according EOTA TR 055 or EN 1992-4:2018

Sormat through bolts S-KA/S-KAK/S-KAH				Anchor size		
				M6-1	M6-2	M8
Steel failure						
Characteristic resistance	S-KA/S-KAK	$N_{Rk,s}$	[kN]	8,6		14,8
	S-KAH			9,9		15,8
Partial safety factor		γ_{Ms} 2)	[-]	1,4		
Pull-out failure						
Characteristic resistance in **cracked** and **non-cracked** concrete C20/25	S-KA/S-KAK	$N_{Rk,p}$	[kN]	2,0	3,5	7,0
	S-KAH			3,0	5,0	7,0
Increasing factor for $N_{Rk,p}$		Ψ_C	C25/30	1,12	1,12	1,08
			C30/37	1,22	1,22	1,15
			C35/45	1,32	1,32	1,20
			C40/50	1,41	1,41	1,26
			C45/55	1,50	1,50	1,32
			C50/60	1,58	1,58	1,44
Partial safety factor		γ_{inst} 2)	[-]	1,0		
		γ_{Mp} 3)	[-]	1,5 3)		
Concrete cone and splitting failure						
Effective anchorage depth		h_{ef}	[mm]	25	35	35
Factor for cracked concrete		k_{cr}	[-]	7,7		
Factor for non-cracked concrete		k_{ucr}	[-]	11,0		
Spacing		$s_{cr,N}$	[mm]	75	105	105
Edge distance		$c_{cr,N}$	[mm]	37,5	52,5	52,5
Spacing (splitting)		$s_{cr,sp}$	[mm]	140	120	120
Edge distance (splitting)		$c_{cr,sp}$	[mm]	70	60	60
Partial safety factor		γ_{Msp} 2)	[-]	1,5		

1) Pull-out failure is not decisive
2) In absence of other national regulations
3) The installation safety factor of γ_2 = 1,0 is included

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Sormat through bolts S-KA/S-KAK/S-KAH	Annex C1
Performance Characteristic resistance under tension loads	

Table C2: Characteristic resistances under shear loads in case of static and quasi-static loading for design according to EOTA TR 055 or EN 1992-4:2018

Sormat through bolts S-KA/S-KAK/S-KAH				Anchor size		
				M6-1	M6-2	M8
Steel failure without lever arm						
Characteristic resistance	S-KA/S-KAK	$V_{Rk,s}$	[kN]	/	4,3	10,0
	S-KAH			/	12	13,4
Partial safety factor		γ_{Ms} [1)]	[-]	1,25		
Factor for considering ductility		k_7	[-]	1		
Steel failure with lever arm						
Characteristic resistance	S-KA/S-KAK	$M^0_{Rk,s}$	[Nm]	7		20
	S-KAH			9		22
Partial safety factor		γ_{Ms} [1)]	[-]	1,25		
Concrete pryout failure						
k-factor		k_8	[-]	1	1	1
Partial safety factor		γ_{Mc} [1)]	[-]	1,5		
Concrete edge failure						
Effective length of anchor under shear load		l_f	[mm]	25	35	35
Outside diameter of anchor		d_{nom}	[mm]	6	6	8
Uncracked and cracked concrete without any edge reinforcement		$\Psi_{re,V}$	[-]	1,0		
Cracked concrete with straight edge reinforcement > Ø12 mm				1,2		
Uncracked or cracked concrete with edge reinforcement and closely spaced stirrups (a ≤ 100mm and a ≤ $2c_1$)				1,4		
Partial safety factor		γ_{Mc} [1)]	[-]	1,5		

[1)] In absence of other national regulations

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Sormat through bolts S-KA/S-KAK/S-KAH	Annex C2
Performance Characteristic resistance under shear loads	

Table C3: Characteristic resistances under tension loads in case of fire exposure for design according to EOTA TR 020 or EN 1992-4:2018

Sormat through bolts S-KA/S-KAK/S-KAH				Anchor size		
				M6-1	M6-2	M8
Steel failure						
Characteristic resistance $N_{Rk,s,fi}$	S-KA/S-KAK	R30	[kN]	/	0,16	0,26
		R60	[kN]	/	0,14	0,24
		R90	[kN]	/	0,11	0,18
		R120	[kN]	/	0,08	0,13
	S-KAH	R30	[kN]	/	0,16	0,53
		R60	[kN]	/	0,14	0,42
		R90	[kN]	/	0,11	0,32
		R120	[kN]	/	0,08	0,26
Pull-out failure						
Characteristic resistance $N_{Rk,p,fi}$	S-KA/S-KAK	R30	[kN]	0,50	0,50	1,75
		R60	[kN]	0,50	0,50	1,75
		R90	[kN]	0,50	0,50	1,75
		R120	[kN]	0,40	0,40	1,40
	S-KAH	R30	[kN]	0,75	0,75	1,63
		R60	[kN]	0,75	0,75	1,63
		R90	[kN]	0,75	0,75	1,63
		R120	[kN]	0,60	0,60	1,30
Concrete cone and splitting failure [1)]						
Characteristic resistance $N^0_{Rk,c,fi}$		R30	[kN]	0,56	1,30	1,30
		R60	[kN]	0,56	1,30	1,30
		R90	[kN]	0,56	1,30	1,30
		R120	[kN]	0,45	1,04	1,04
Spacing		$s_{cr,N,fi}$	[mm]	$4 \times h_{ef}$		
		s_{min}	[mm]	50	40	60
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 the design method given in EOTA TR 020.

Under fire exposure usually cracked concrete is assumed. The design equations are given in EOTA 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.

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Sormat through bolts S-KA/S-KAK/S-KAH	
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 EOTA TR 020 or EN 1992-4:2018

Sormat through bolts S-KA/S-KAK/S-KAH				Anchor size		
				M6-1	M6-2	M8
Steel failure without lever arm						
Characteristic resistance $V_{Rk,s,fi}$	S-KA/S-KAK	R30	[kN]	/	0,16	0,26
		R60	[kN]	/	0,14	0,24
		R90	[kN]	/	0,11	0,18
		R120	[kN]	/	0,08	0,13
	S-KAH	R30	[kN]	/	0,16	0,53
		R60	[kN]	/	0,14	0,42
		R90	[kN]	/	0,11	0,32
		R120	[kN]	/	0,08	0,26
Steel failure with lever arm						
Characteristic resistance $M^0_{Rk,s,fi}$	S-KA/S-KAK	R30	[kN]	/	0,15	0,37
		R60	[kN]	/	0,14	0,34
		R90	[kN]	/	0,11	0,26
		R120	[kN]	/	0,08	0,19
	S-KAH	R30	[kN]	/	0,15	0,75
		R60	[kN]	/	0,14	0,60
		R90	[kN]	/	0,11	0,40
		R120	[kN]	/	0,08	0,37
Concrete pryout failure						
k-factor		k_8	[-]	1	1	1
Characteristic resistance $V_{Rk,cp,fi}$		R30	[kN]	0,56	1,30	1,30
		R60	[kN]	0,56	1,30	1,30
		R90	[kN]	0,56	1,30	1,30
		R120	[kN]	0,45	1,04	1,04
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 the design method given in EOTA TR 020.

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

EOTA 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 $\geq 2 \times h_{ef}$.

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

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Sormat through bolts S-KA/S-KAK/S-KAH	
Performance Characteristic shear resistance under fire exposure	**Annex C4**