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## European Technical Assessment

ETA-10/0076

of 8/9/2016

### 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**

**THROUGH BOLTS SITA ACCIAIO S1K, SHD1K, S11K, AND SIH1K**

**PRODUCT FAMILY TO WHICH THE CONSTRUCTION PRODUCT BELONGS**

TORQUE CONTROLLED EXPANSION ANCHORS OF SIZES M8, M10, M12 AND M16 FOR USE IN CONCRETE

**MANUFACTURER**

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**MANUFACTURING PLANT**

G&B FISSAGGI PLANT 2

**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-10/0076 from 06/06/2013

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## SPECIFIC PART

### 1. Technical description of the product

The SITA ACCIAIO through bolt S1K is an anchor made of galvanized steel (designated as S1K). The SITA ACCIAIO through bolt SHD1K is an anchor made of hot dip galvanized steel (designated as SHD1K). The SITA ACCIAIO through bolt S11K is an anchor made of stainless steel (designated as S11K). The SITA ACCIAIO through bolt SIH1K is an anchor made of high corrosion resistant stainless steel (designated as SIH1K). 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. 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 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	Anchorage 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 approval, 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)

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<sup>1</sup>, 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 applies:

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 September 8, 2016  
by VTT Expert Services Ltd



Tiina Ala-Outinen  
Business Manager

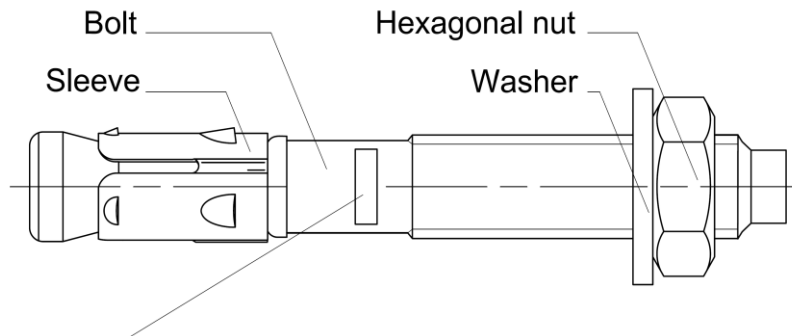


Pertti Jokinen  
Product Manager

<sup>1</sup>

Official Journal of the European Communities L 254 of 08.10.1996

## SITA ACCIAIO through bolt

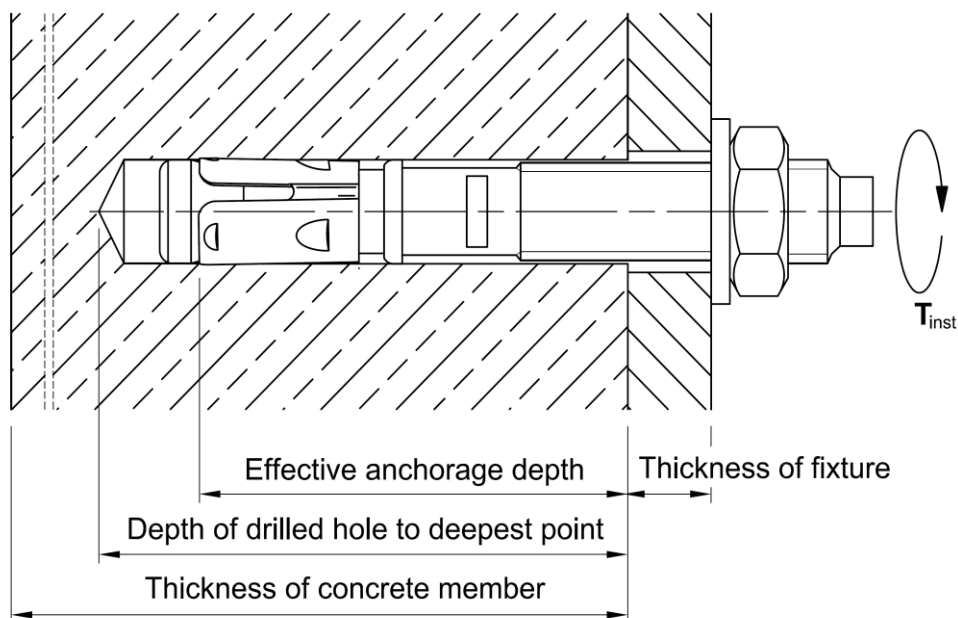


<b>Marking:</b>	Identifying mark:	S
	Anchor identity:	KA
	Category * <sup>1)</sup> :	H (stainless steel) K (hot dip galvanized)
	Thread size:	M8 ... M16
	Max. fixture thickness:	$t_{fix}$
	Material * <sup>1)</sup> :	HCR

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

\*<sup>1)</sup> : Where applicable

## SITA ACCIAIO through bolt after installation



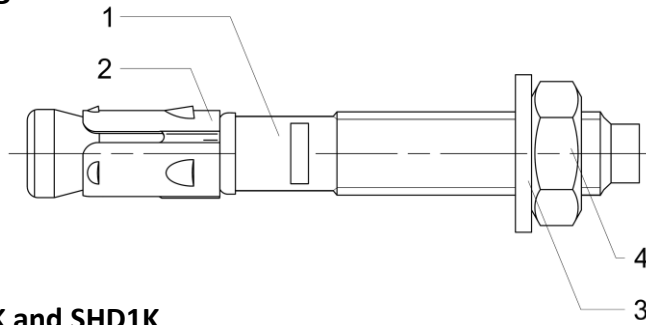
SITA ACCIAIO through bolt

Product description

Installation condition

Annex A1

## SITA ACCIAIO through bolt



**Table A1: Materials S1K and SHD1K**

Part	Designation	Diameter	Material <sup>1) 2)</sup>
1	Bolt	M8 - M16	Cold forged steel, EN 10263-2
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)

<sup>1)</sup> **S1K:** Parts 1, 3 and 4 are zinc electroplated according to EN ISO 4042  $\geq 5\mu\text{m}$  and bright passivated

<sup>2)</sup> **SHD1K:** Parts 1, 3 and 4 are hot dip galvanized  $> 40\mu\text{m}$  according to EN ISO 10684

**Table A2: Materials S11K**

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 SIH1K**

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)

**SITA ACCIAIO through bolt**

**Product description**

Materials

**Annex A2**

## Specifications of intended use

### Anchorage 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: 2013

### Use conditions (Environmental conditions):

- The S1K and SHD1K anchors may only be used in structures subject to dry indoor conditions, indoor with temporary condensation.
- The SI1K 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 SIH1K 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 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 TR 045 "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 EOTA TR 020 "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 non-shrinkage mortar. No shear or oblique tension loads are allowed in the direction of a not filled aborted hole.

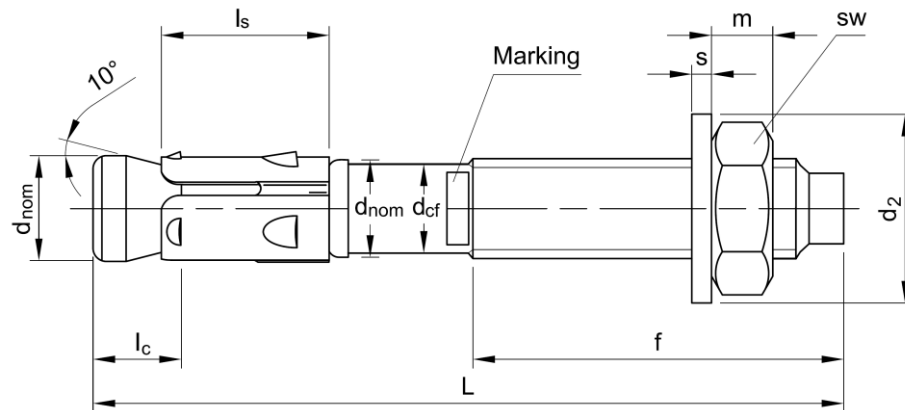
**SITA ACCIAIO through bolt**

**Intended Use**

Specifications

**Annex B1**

## SITA ACCIAIO through bolt



**Table B1: Dimensions of the anchor**

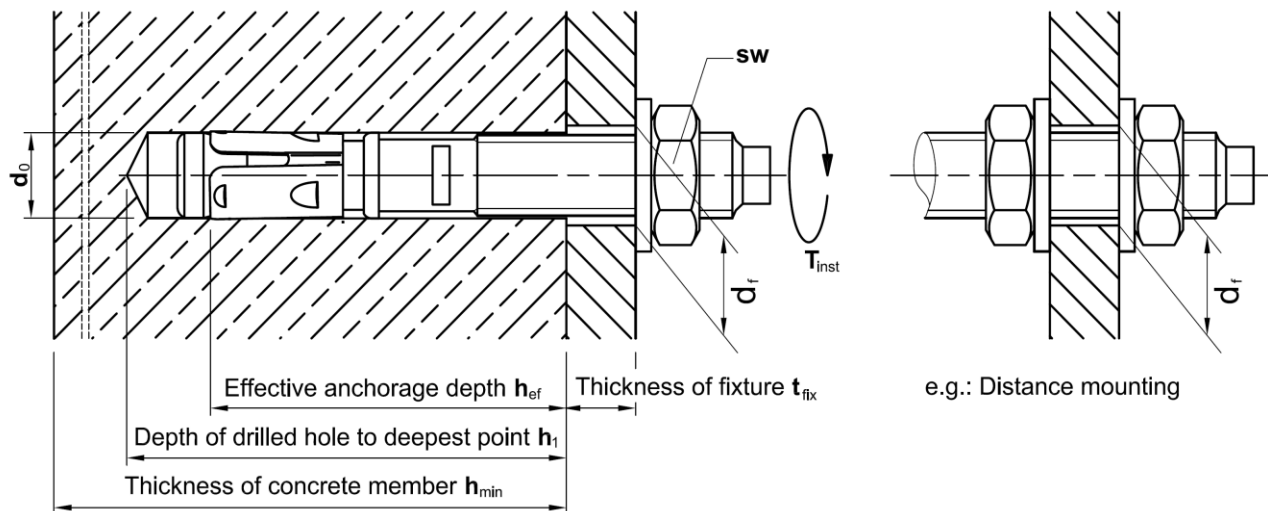
Main dimensions		Stud bolt		Cone bolt		Expansion sleeve	Washer			Hexagonal nut	
Size	L [mm]	f [mm]	d <sub>cf</sub> [mm]	d <sub>nom</sub> [mm]	l <sub>c</sub> [mm]	l <sub>s</sub> [mm]	s [mm]	d <sub>1</sub> [mm]	d <sub>2</sub> [mm]	SW [mm]	m [mm]
<b>M8</b>	62...420	22...220	7,1	8	20,9	15,9	≥1,6	≥8,4	≥16	13	≥6,5
<b>M10</b>	82...420	37...215	9,0	10	25,7	17,9	≥2,0	≥10,5	≥20	≥16	≥8,0
<b>M12</b>	98...420	48...210	10,8	12	30,3	19,1	≥2,5	≥13,0	≥24	≥18	≥10,0
<b>M16</b>	118...420	60...202	14,6	16	38,1	26,3	≥3,0	≥17,0	≥30	24	≥13,0

**SITA ACCIAIO through bolt**

**Intended Use**

Anchor dimensions

**Annex B2**



**Table B2: Installation data**

SITA ACCIAIO 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	$\geq 16$	$\geq 18$	24
Required torque	$T_{inst}$ [Nm]	20 / 15 <sup>1)</sup>	35	50	120
		20	35	70	120

<sup>1)</sup> Installation torque for S1K is 20 Nm and for SHD1K 15 Nm

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

SITA ACCIAIO 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

Intervals may be interpolated linearly

**SITA ACCIAIO through bolt**

**Intended Use**  
Installation data

**Annex B3**



**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**

SITA ACCIAIO through bolt			Anchor size			
			M8	M10	M12	M16
<b>Steel failure</b>						
Characteristic resistance S1K / SHD1K	$N_{Rk,s}$	[kN]	13	26	38	69
Characteristic resistance SI1K / SIH1K	$N_{Rk,s}$	[kN]	15	24	35	75
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1,4			
<b>Pull-out failure</b>						
Characteristic resistance in <b>cracked</b> concrete C20/25	$N_{Rk,p}$	[kN]	5	9	12	20
Characteristic resistance in <b>non-cracked</b> concrete C20/25	$N_{Rk,p}$	[kN]	9	16	20	35
Increasing factor for $N_{Rk,p}$	$\psi_c$	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	$\gamma_{Mp}^{1)}$	[-]	1,8 <sup>2)</sup>			1,5 <sup>3)</sup>
<b>Concrete cone and splitting failure</b>						
Effective anchorage depth	$h_{ef}$	[mm]	45	60	70	85
Factor for cracked concrete	$k_{cr}$	[-]	7,2			
Factor for non-cracked concrete	$k_{ucr}$	[-]	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	$\gamma_{Mc}^{1)}$ $\gamma_{Msp}^{1)}$	[-]	1,8 <sup>2)</sup>			1,5 <sup>3)</sup>

<sup>1)</sup> In absence of other national regulations

<sup>2)</sup> The installation safety factor of  $\gamma_2 = 1,2$  is included

<sup>3)</sup> The installation safety factor of  $\gamma_2 = 1,0$  is included

SITA ACCIAIO 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 method A according to ETAG 001, Annex C or CEN/TS 1992-4**

SITA ACCIAIO through bolt			Anchor size			
			M8	M10	M12	M16
<b>Steel failure without lever arm</b>						
Characteristic resistance S1K / SHD1K	$V_{Rk,s}$	[kN]	10	18	23	44
Characteristic resistance S1K / SIH1K	$V_{Rk,s}$	[kN]	11	17	25	47
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1,25			
Factor for considering ductility	$k_2$	[-]	1,0			
<b>Steel failure with lever arm</b>						
Characteristic resistance S1K / SHD1K	$M_{Rk,s}^0$	[Nm]	21	48	72	186
Characteristic resistance S1K / SIH1K	$M_{Rk,s}^0$	[Nm]	22	45	79	200
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1,25			
<b>Concrete pryout failure</b>						
k-factor	$k_{(3)}$	[-]	1	2		
Partial safety factor	$\gamma_{Mc}^{1)}$	[-]	1,5			
<b>Concrete edge failure</b>						
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
<b>Cracked concrete</b> without any edge reinforcement	$\psi_{ucr,V}$	[-]	1,0			
<b>Cracked concrete</b> with straight edge reinforcement > Ø12 mm			1,2			
<b>Cracked concrete</b> with edge reinforcement and closely spaced stirrups ( $a \leq 100\text{mm}$ ) or <b>non-cracked concrete</b>			1,4			
Partial safety factor	$\gamma_{Mc}^{1)}$	[-]	1,5			

<sup>1)</sup> In absence of other national regulations

SITA ACCIAIO through bolt

Performance

Characteristic resistance under shear loads

Annex C2

**Table C3: Characteristic resistances under tension loads in case of fire exposure for design method A according to EOTA TR 020 and ETAG 001, Annex C or CEN/TS 1992-4**

SITA ACCIAIO through bolt				Anchor size			
				M8	M10	M12	M16
<b>Steel failure</b>							
Characteristic resistance $N_{Rk,s,fi}$	S1K / SHD1K	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
	S1K / SIH1K	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
<b>Pull-out failure</b>							
Characteristic resistance $N_{Rk,p,fi}$	S1K / SHD1K	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 $N_{Rk,p,fi}$	S1K / SIH1K	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
<b>Concrete cone and splitting failure <sup>1)</sup></b>							
Characteristic resistance $N_{Rk,c,fi}^0$	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: $c_{min} = 2 \times h_{ef}$				
			Fire attack from more than one side: $c_{min} \geq 300 \text{ mm and } \geq 2 \times h_{ef}$				

<sup>1)</sup> 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.

<b>SITA ACCIAIO through bolt</b>	<b>Annex C3</b>
<b>Performance</b> Characteristic tension resistance under fire exposure	

**Table C4: Characteristic resistances under shear loads in case of fire exposure for design method A according to EOTA TR 020 and ETAG 001, Annex C or CEN/TS 1992-4**

SITA ACCIAIO through bolt				Anchor size			
				M8	M10	M12	M16
<b>Steel failure without lever arm</b>							
Characteristic resistance $V_{Rk,s,fi}$	S1K / SHD1K	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
	SI1K / SIH1K	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
<b>Steel failure with lever arm</b>							
Characteristic resistance $M_{Rk,s,fi}^0$	S1K / SHD1K	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
	SI1K / SIH1K	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
<b>Concrete pryout failure</b>							
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	
<b>Concrete edge failure</b>							
The initial value $V_{Rk,c,fi}^0$ of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:							
$V_{Rk,c,fi}^0 = 0,25 \times V_{Rk,c}^0 \quad (\leq R90) \quad \quad V_{Rk,c,fi}^0 = 0,20 \times V_{Rk,c}^0 \quad (R120)$							
with $V_{Rk,c}^0$ 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.

<b>SITA ACCIAIO through bolt</b>	<b>Annex C4</b>
<b>Performance</b> Characteristic shear resistance under fire exposure	

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

SITA ACCIAIO 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
	$\delta_{N0}$	[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**

SITA ACCIAIO 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
	$\delta_{V0}$	[mm]	1,7	1,7	2,4	3,2
	$\delta_{V\infty}$	[mm]	2,6	2,6	3,6	4,8

**SITA ACCIAIO 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. EOTA TR 045: Performance Category C1**

SITA ACCIAIO through bolt			Anchor size			
			M8	M10	M12	M16
<b>Steel failure</b>						
Characteristic resistance S1K	$N_{Rk,s,seis}$	[kN]	13	26	38	69
Characteristic resistance SI1K	$N_{Rk,s,seis}$	[kN]	15	24	35	75
Partial safety factor	$\gamma_{Ms,seis}^{1)}$	[-]	1,4			
<b>Pull-out failure</b>						
Characteristic resistance in <b>cracked</b> concrete C20/25	$N_{Rk,p,seis}$	[kN]	5	9	12	20
Partial safety factor	$\gamma_{Mp,seis}^{1)}$	[-]	1,8 <sup>2)</sup>			1,5 <sup>3)</sup>
<b>Concrete cone and splitting failure<sup>4)</sup></b>						
Effective anchorage depth	$h_{ef}$	[mm]	45	60	70	85
Partial safety factor	$\gamma_{Mc,seis}^{1)}$ $\gamma_{Msp,seis}^{1)}$	[-]	1,8 <sup>2)</sup>			1,5 <sup>3)</sup>

<sup>1)</sup> In absence of other national regulations

<sup>2)</sup> The installation safety factor of  $\gamma_2 = 1,2$  is included

<sup>3)</sup> The installation safety factor of  $\gamma_2 = 1,0$  is included

<sup>4)</sup> For concrete cone and splitting failure, see EOTA TR 045

**Table C8: Characteristic resistances under shear loads in case of seismic action**  
**Design acc. EOTA TR 045: Performance Category C1**

SITA ACCIAIO through bolt			Anchor size			
			M8	M10	M12	M16
<b>Steel failure without lever arm</b>						
Characteristic resistance S1K	$V_{Rk,s,seis}$	[kN]	5,6	11,9	15,4	31,2
Characteristic resistance SI1K	$V_{Rk,s,seis}$	[kN]	8,7	11,2	18,3	31,5
Partial safety factor	$\gamma_{Ms,seis}^{1)}$	[-]	1,25			
<b>Concrete pryout and concrete edge failure<sup>2)</sup></b>						
Effective anchorage depth	$h_{ef}$	[mm]	45	60	70	85
Partial safety factor	$\gamma_{Mc,seis}^{1)}$	[-]	1,5			

<sup>1)</sup> In absence of other national regulations

<sup>2)</sup> For concrete pryout and edge failure, see EOTA TR 045

**SITA ACCIAIO through bolt**

**Performance**

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

**Annex C6**