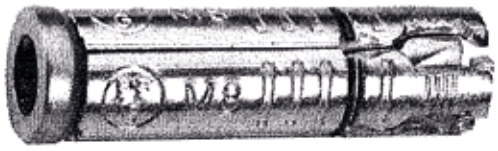
ES PFG® Keilboutankers



De oorspronkelijke schildankers met extra spreiding voor lage-kwaliteit beton

- Momentgecontroleerde schildankers voor pre- en afstandsinstallaties afhankelijk van het type.
- 4-weg extra brede spreiding voor goede prestaties ook in lagere kwaliteit basismaterialen in vele oude constructies.
- Goede tolerantie voor variatie in de grootte van het boorgat.
- ES met interne draad voor gebruik met bouten en staven.
- ZP voor droog binnen en tijdelijk gebruik buiten.

TECHNISCHE KENMERKEN

Materiaal	Staal, elektrolytisch verzinkt
Geschikte omstandigheden	Droog binnen

TOEPASSINGEN

- Staalconstructies
- Gevelsteigers
- Poorten
- Gevelsystemen
- Zonneschermen
- Stalen structuren
- Buissteunen

BASISMATERIALEN

GOEDGEKEURD VOOR

- Niet gescheurd beton

OOK GESCHIKT VOOR

- Natuursteen
- Geperforeerde bakstenen
- Metselwerk van massieve stenen

GOEDKEURINGEN / CERTIFICATEN

ETA-01/0012 + DoPs

TC 4635-15

0679-CPR-0452

Vuurweerstand
(ETA-01/0012)

ES Producten

TYPE	CODE	ETA KEURING	AFMETING	LENGTE	BOORGAT DIAMETER
ES 6	77501	Ja	M6 mm	40 mm	10 mm
ES 8	77502	Ja	M8 mm	50 mm	14 mm
ES 10	77503	Ja	M10 mm	60 mm	16 mm
ES 12	77504	Ja	M12 mm	80 mm	20 mm
ES 16	77505	Nee	M16 mm	100 mm	25 mm

februari 5, 2016 9:20 am GMT

CSTB
le futur en construction

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

Member of EOTA
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European Technical Assessment

ETA-01/0012 of 23/06/2014

English translation prepared by CSTB - Original version in French language

General Part

Nom commercial *Trade name*	**SORMAT PFG LB / SB / ES**
Famille de produit *Product family*	**Cheville métallique en acier galvanisé, à expansion par vissage à couple contrôlé, de fixation dans le béton non fissuré : diamètres M6, M8, M10 et M12.** ***Torque-controlled expansion anchor, made of galvanised steel, for use in non cracked concrete: sizes M6, M8, M10 and M12.***
Titulaire *Manufacturer*	
Usine de fabrication *Manufacturing plants*	
Cette evaluation contient: *This Assessment contains*	14 pages incluant 11 annexes qui font partie intégrante de cette évaluation *14 pages including 11 annexes which form an integral part of this assessment*
Base de l'ETE *Basis of ETA*	ETAG 001, Version April 2013, utilisée en tant que EAD *ETAG 001, Edition April 2013 used as EAD*
Cette evaluation remplace: *This Assessment replaces*	ATE 01/0012 valide du 09/05/2011 au 09/05/2016 *ETA-01/0012 with validity from 09/05/2011 to 09/05/2016*

Specific Part

1 Technical description of the product

The PFG bolt type LB, ES and SB anchor in the range of M6 to M12 is an anchor made of galvanised steel, which is placed into a drilled hole and anchored by torque-controlled expansion. The LB version is the complete version with screw and washer. The ES version is made of the expansion system (shield, cone, ferule and coil spring) and can only be used with a steel grade 8.8 ISO 898-1 bolt and a washer whose material characteristics are given in Annex A2. The version SB consists of a threaded rod with conical end instead of the screw and of the cone.

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

2 Specification of the intended use

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic tension resistance acc. ETAG001, Annex C	See Annex C 1
Characteristic shear resistance acc. ETAG001, Annex C	See Annex C 1
Characteristic tension resistance acc. CEN/TS 1992-4	See Annex C 4
Characteristic shear resistance acc. CEN/TS 1992-4	See Annex C 4
Displacements	See Annex C 7

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 acc. ETAG001, Annex C	See Annex C2
Characteristic shear resistance under fire acc. ETAG001, Annex C	See Annex C3
Characteristic tension resistance under fire acc. CEN/TS 1992-4	See Annex C5
Characteristic shear resistance under fire acc. CEN/TS 1992-4	See Annex C6

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 as for Basic 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)

For the sustainable use of natural resources no performance was determined for this product.

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) 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

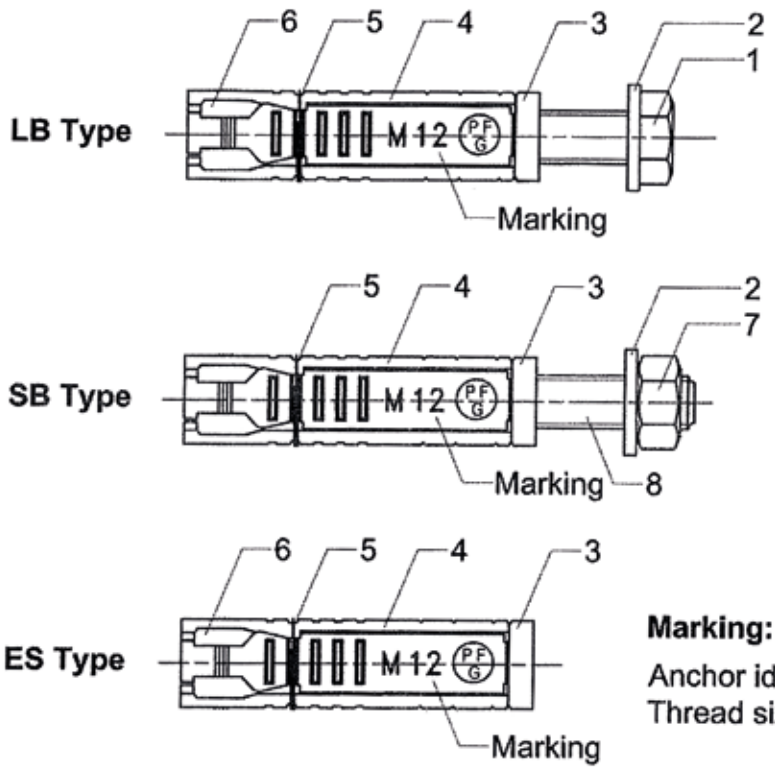
Technical details necessary for the implementation of the Assessment and verification of constancy of performance (AVCP) system are laid down in the control plan deposited at Centre Scientifique et Technique du Bâtiment.

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 Marne La Vallée on 23-06-2014 by
Charles Baloche
Directeur technique

The original French version is signed

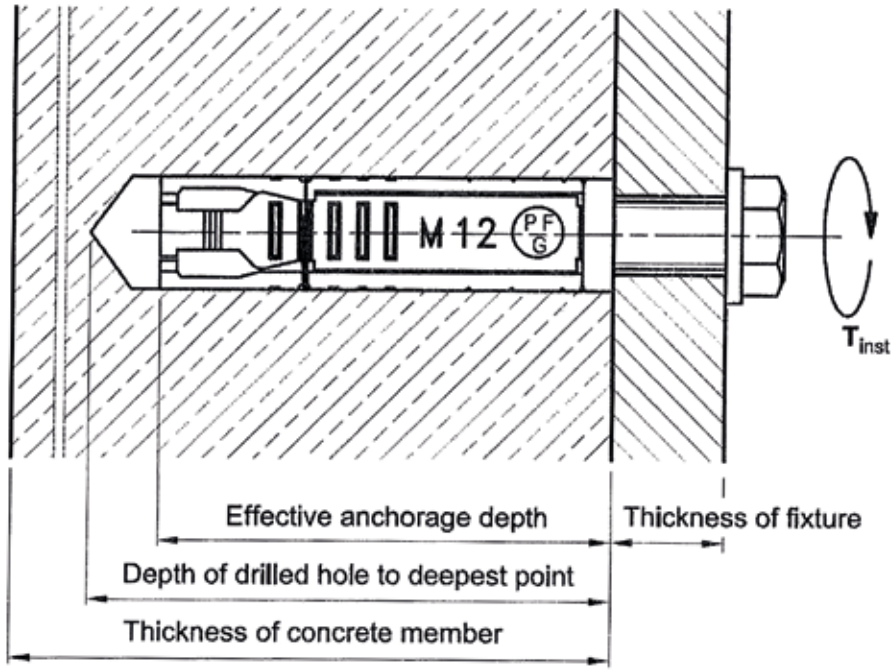
1 Official Journal of the European Communities L 254 of 08.10.1996



1. Hex screw
2. Washer
3. Capsule
4. Shields
5. Coil spring
6. Conical nut
7. Hexagonal nut
8. Stud bolt

Marking:

Anchor identity: PFG
Thread size: M6 ... M12



Product description Installation condition	**Annex A1**

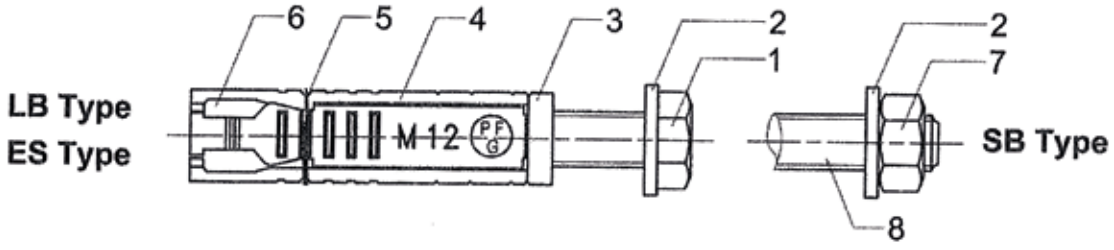


Table A1 : Materials PFG [1)]

Part	Designation	Material	Coating [2)]
1	Hexagonal Bolt	DIN 933 (EN ISO 4017) / DIN 931 (EN ISO 4014) EN ISO 898-1: property class 8.8	zinc electroplated
2	Washer	DIN 125 (EN ISO 7089) / DIN 440 (EN ISO 7094) / DIN 9021 (EN ISO 7093)	zinc electroplated
3	Capsule	Cold formed steel	zinc electroplated
4	Shields	Cold formed steel	zinc electroplated
5	Coil Spring	Steel wire DIN 17223 BL1, Class B	-
6	Conical Nut	EN ISO 898-2: property class 8	zinc electroplated
7	Hexagonal Nut	DIN 934 (EN ISO 4032) EN ISO 898-2: property class 8	zinc electroplated
8	Stud Bolt	EN ISO 898-1: property class 8.8	zinc electroplated

[1)] The same type of anchor with sherardized/blackdized shields is not covered by this ETA.
[2)] Parts 1-4 and 6-8 are zinc electroplated according to EN ISO 4042 ≥ 5µm and bright passivated.

Product description Materials	Annex A2

Specifications of intended use

Anchorages subject to:

- Static, quasi-static and loads under fire

Base materials:

- 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: 2000-12.

Use conditions (Environmental conditions):

- Structures subject to dry indoor conditions, indoor with temporary condensation.

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 application with resistance under fire exposure the anchorages are designed in accordance with 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 spacing 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 wrench
- 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.

Intended Use Specifications	**Annex B1**

Table B1: Anchor dimensions

Main dimensions					Washer [*1)]			Hexagonal Bolt [*2)] (LB type)		Hexagonal Nut [*3)] (SB type)	
type LB / SB / ES	Size	L [mm]	d [mm]	d_{nom} [mm]	s [mm]	d_1 [mm]	d_2 [mm]	sw [mm]	k [mm]	sw [mm]	m [mm]
6 - t_{fix}	M6	40	6	10	1.6 / 1.6 / 2	6.4 / 6.4 / 6.6	12 / 18 / 22	10	4.0	10	5.2 / 6.5
8 - t_{fix}	M8	50	8	14	1.6 / 2 / 2	8.4 / 8.4 / 9	16 / 24 /28	13	5.3	13	6.8 / 8.0
10 - t_{fix}	M10	60	10	16	2 / 2.5 / 3	10.5 / 10.5 / 11	20 / 30 /34	16 / 17	6.4	16 / 17	8.4 / 10
12 - t_{fix}	M12	80	12	20	2.5 / 3 / 4	13 / 13 / 13.5	24 / 37 /44	18 / 19	7.5	18 / 19	10.8 / 13

[*1)]: EN ISO 7089 / EN ISO 7093 / EN ISO 7094
[*2)]: EN ISO 4017 and EN ISO 4014 / DIN 933 and DIN 931
[*3)]: EN ISO 4032 / DIN 934

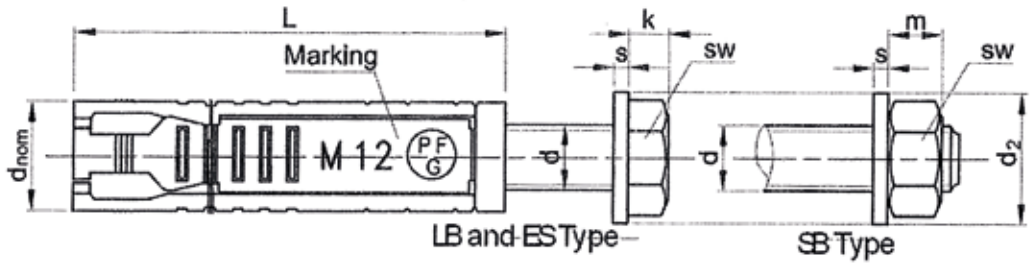
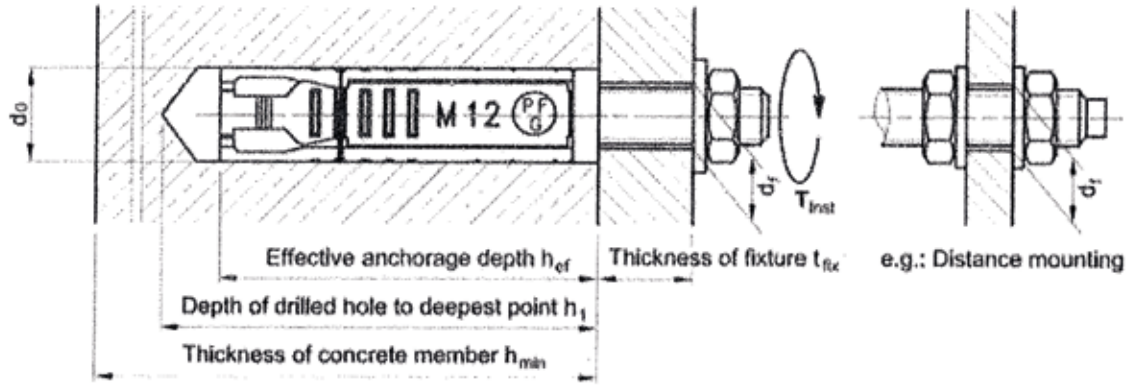


Table B2: Installation data

[redacted] anchor LB / SB / ES			Anchor size			
			M6	M8	M10	M12
Drill hole diameter	d_0	[mm]	10	14	16	20
Cutting diameter at the upper tolerance limit (maximum diameter bit)	$d_{cut,max} \leq$	[mm]	10.45	14.5	16.5	20.55
Depth of drilled hole to deepest point	$h_1 \geq$	[mm]	45	55	65	85
Effective anchorage depth	h_{ef}	[mm]	40	50	60	80
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7	9	11	13
Thickness of fixture	$t_{fix,min...max}$	[mm]	0...100	0...120	0...140	0...160
Required torque	T_{inst}	[Nm]	10	25	50	85
Minimum thickness of concrete member	h_{min}	[mm]	100	100	120	160
Minimum spacing	s_{min}	[mm]	60	75	90	120
Minimum edge distance	c_{min}	[mm]	60	75	90	120



Intended Use
Installation parameters

Annex B2

Table C1: Characteristic values for tension loads in case of static and quasi static loading for design method A acc. ETAG 001, Annex C

[redacted] anchor LB / SB / ES			Anchor size			
			M6	M8	M10	M12
Steel failure						
Characteristic resistance (reduced part)	$N_{Rk,s}$	[kN]	16	29	46	67
Partial safety factor	γ_{Ms} [1)]	[-]	1.50			
Pull-out failure						
Characteristic resistance in **non-cracked** concrete C20/25	$N^0_{Rk,p}$	[kN]	5	9	12	16
Partial safety factor	γ_{Mp} [1)]	[-]	1.50 [2)]			
Concrete cone failure						
Effective anchorage depth	h_{ef}	[mm]	40	50	60	80
Spacing	$s_{cr,N}$	[mm]	120	150	180	240
Edge distance	$c_{cr,N}$	[mm]	60	75	90	120
Partial safety factor	γ_{Mc} [1)]	[-]	1.50 [2)]			
Concrete splitting failure						
Spacing (splitting)	$s_{cr,sp}$	[mm]	240	300	360	480
Edge distance (splitting)	$c_{cr,sp}$	[mm]	120	150	180	240
Partial safety factor	γ_{Msp} [1)]	[-]	1.50 [2)]			

[1)] In the absence of other national regulations
[2)] The installation safety factor of $\gamma 2 = 1{,}0$ is included.

Table C2: Characteristic values for shear loads in case of static and quasi static loading for design method A acc. ETAG 001, Annex C

[redacted] anchor LB / SB / ES			Anchor size			
			M6	M8	M10	M12
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s}$	[kN]	8	14	23	33
Partial safety factor	γ_{Ms} [1)]	[-]	1.25			
Steel failure with lever arm						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	12	30	60	105
Partial safety factor	γ_{Ms} [1)]	[-]	1.25			
Concrete pryout failure						
Factor in eq. (5.6) of ETAG Annex C, § 5.2.3.3	k	[-]	1		2	
Partial safety factor	γ_{Mcp} [1)]	[-]	1.50 [2)]			
Concrete edge failure						
Effective length of anchor under shear load	l_f	[mm]	26	33	40	53
Outside diameter of anchor	d_{nom}	[mm]	10	14	16	20
Partial safety factor	γ_{Mc} [1)]	[-]	1.50 [2)]			

Design according to ETAG 001, Annex C
Characteristic resistance under tension and shear loads

Annex C1

Table C3: Characteristic tension resistance under fire exposure for design method A according to ETAG 001, Annex C

[redacted] anchor LB / SB / ES			Anchor size			
			M6	M8	M10	M12
Steel failure						
Characteristic resistance	R30 $N_{Rk,s,fi}$	[kN]	0.2	0.4	0.9	1.7
	R60 $N_{Rk,s,fi}$	[kN]	0.2	0.3	0.8	1.3
	R90 $N_{Rk,s,fi}$	[kN]	0.1	0.3	0.6	1.1
	R120 $N_{Rk,s,fi}$	[kN]	0.1	0.2	0.5	0.8
Pull-out failure						
Characteristic resistance	R30 $N_{Rk,p,fi}$	[kN]	1.3	2.3	3.0	4.0
	R60 $N_{Rk,p,fi}$	[kN]	1.3	2.3	3.0	4.0
	R90 $N_{Rk,p,fi}$	[kN]	1.3	2.3	3.0	4.0
	R120 $N_{Rk,p,fi}$	[kN]	1.0	1.8	2.4	3.2
Concrete cone and splitting failure [1]						
Characteristic resistance	R30 $N_{Rk,c,fi}$	[kN]	1.8	3.2	5.0	10.3
	R60 $N_{Rk,c,fi}$	[kN]	1.8	3.2	5.0	10.3
	R90 $N_{Rk,c,fi}$	[kN]	1.8	3.2	5.0	10.3
	R120 $N_{Rk,c,fi}$	[kN]	1.5	2.5	4.0	8.2
Spacing	$s_{cr,N,fi}$	[mm]	$4 \times h_{ef}$			
	s_{min}	[mm]	60	75	90	120
Edge distance	$c_{cr,N,fi}$	[mm]	$2 \times h_{ef}$			

[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 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.

Design according to ETAG 001, Annex C
Characteristic tension resistance under fire exposure

Annex C2

Table C4: Characteristic shear resistance under fire exposure for design method A according to ETAG 001, Annex C

[redacted] anchor LB / SB / ES			Anchor size			
			M6	M8	M10	M12
Steel failure without lever arm						
Characteristic resistance	R30 $V^0_{Rk,s,fi}$	[kN]	0.2	0.4	0.9	1.7
	R60 $V^0_{Rk,s,fi}$	[kN]	0.2	0.3	0.8	1.3
	R90 $V^0_{Rk,s,fi}$	[kN]	0.2	0.3	0.6	1.1
	R120 $V^0_{Rk,s,fi}$	[kN]	0.1	0.2	0.5	0.8
Steel failure with lever arm						
Characteristic resistance	R30 $M^0_{Rk,s,fi}$	[kN]	0.2	0.4	1.1	2.6
	R60 $M^0_{Rk,s,fi}$	[kN]	0.1	0.3	1.0	2.0
	R90 $M^0_{Rk,s,fi}$	[kN]	0.1	0.3	0.7	1.7
	R120 $M^0_{Rk,s,fi}$	[kN]	0.1	0.2	0.6	1.3
Concrete pryout failure						
Factor in eq. (5.6) of ETAG Annex C, § 5.2.3.3	k	[-]	1		2	
Characteristic resistance	R30 $N^0_{Rk,cp,fi}$	[kN]	1.8	6.4	10.0	20.6
	R60 $N^0_{Rk,cp,fi}$	[kN]	1.8	6.4	10.0	20.6
	R90 $N^0_{Rk,cp,fi}$	[kN]	1.8	6.4	10.0	20.6
	R120 $N^0_{Rk,cp,fi}$	[kN]	1.5	5.1	8.0	16.5
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.

Design according to ETAG 001, Annex C Characteristic shear resistance under fire exposure	**Annex C3**

Table C5: Characteristic values for tension loads in case of static and quasi static loading for design method A according to CEN/TS 1992-4

[redacted] anchor LB / SB / ES				Anchor size			
				M6	M8	M10	M12
Steel failure							
Characteristic resistance (reduced part)		$N_{Rk,s}$	[kN]	16	29	46	67
Partial safety factor		γ_{Ms} [1)]	[-]	1.50			
Pull-out failure							
Characteristic resistance in **non-cracked** concrete C20/25		$N^0_{Rk,p}$	[kN]	5	9	12	16
Partial safety factor		γ_{Mp} [1)]	[-]	1.50 [2)]			
Concrete cone and splitting failure							
Effective anchorage depth		h_{ef}	[mm]	40	50	60	80
Factor for non-cracked concrete		k_{cr}	[-]	10.1			
Partial safety factor		$\gamma_{Mc} = \gamma_{Msp}$ [1)]	[-]	1.50 [2)]			
Spacing	concrete cone failure	$s_{cr,N}$	[mm]	120	150	180	240
	splitting failure	$s_{cr,sp}$	[mm]	240	300	360	480
Edge distance	concrete cone failure	$c_{cr,N}$	[mm]	60	75	90	120
	splitting failure	$c_{cr,sp}$	[mm]	120	150	180	240

[1)] In the absence of other national regulations.
[2)] The installation safety factor of γ_2 = 1.0 is included.

Table C6: Characteristic values for shear loads in case of static and quasi static loading for design method A according to CEN/TS 1992-4

[redacted] anchor LB / SB / ES			Anchor size			
			M6	M8	M10	M12
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s}$	[kN]	8	14	23	33
Factor considering ductility	k_2	[-]	0.8			
Partial safety factor	γ_{Ms} [1)]	[-]	1.25			
Steel failure with lever arm						
Characteristic resistance	$M^0_{Rk,s}$	[Nm]	12	30	60	105
Partial safety factor	γ_{Ms} [1)]	[-]	1.25			
Concrete pryout failure						
Factor in eq. (16) of CEN/TS 1992-4-4, § 6.2.2.3	k_3	[-]	1		2	
Partial safety factor	γ_{Mcp} [1)]	[-]	1.50 [2)]			
Concrete edge failure						
Effective length of anchor under shear load	l_f	[mm]	26	33	40	53
Outside diameter of anchor	d_{nom}	[mm]	10	14	16	20
Partial safety factor	γ_{Mc} [1)]	[-]	1.50 [2)]			

Design according to CEN/TS 1992-4
Characteristic resistance under tension and shear loads

Annex C4

Table C7: Characteristic tension resistance under fire exposure for design method A according to CEN/TS 1992-4

[redacted] anchor LB / SB / ES			Anchor size			
			M6	M8	M10	M12
Steel failure						
Characteristic resistance	R30 $N_{Rk,s,fi}$	[kN]	0.2	0.4	0.9	1.7
	R60 $N_{Rk,s,fi}$	[kN]	0.2	0.3	0.8	1.3
	R90 $N_{Rk,s,fi}$	[kN]	0.1	0.3	0.6	1.1
	R120 $N_{Rk,s,fi}$	[kN]	0.1	0.2	0.5	0.8
Pull-out failure						
Characteristic resistance	R30 $N_{Rk,p,fi}$	[kN]	1.3	2.3	3.0	4.0
	R60 $N_{Rk,p,fi}$	[kN]	1.3	2.3	3.0	4.0
	R90 $N_{Rk,p,fi}$	[kN]	1.3	2.3	3.0	4.0
	R120 $N_{Rk,p,fi}$	[kN]	1.0	1.8	2.4	3.2
Concrete cone and splitting failure [1)]						
Characteristic resistance	R30 $N_{Rk,c,fi}$	[kN]	1.8	3.2	5.0	10.3
	R60 $N_{Rk,c,fi}$	[kN]	1.8	3.2	5.0	10.3
	R90 $N_{Rk,c,fi}$	[kN]	1.8	3.2	5.0	10.3
	R120 $N_{Rk,c,fi}$	[kN]	1.5	2.5	4.0	8.2
Spacing	$s_{cr,N,fi}$	[mm]	4 x h_{ef}			
	s_{min}	[mm]	60	75	90	120
Edge distance	$c_{cr,N,fi}$	[mm]	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.

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.

Design according to CEN/TS 1992-4
Characteristic tension resistance under fire exposure

Annex C5

Table C8: Characteristic shear resistance under fire exposure for design method A according to CEN/TS 1992-4

SORMAT PFG anchor LB / SB / ES			Anchor size			
			M6	M8	M10	M12
Steel failure without lever arm						
Characteristic resistance	R30 $V_{Rk,s,fi}$	[kN]	0.2	0.4	0.9	1.7
	R60 $V_{Rk,s,fi}$	[kN]	0.2	0.3	0.8	1.3
	R90 $V_{Rk,s,fi}$	[kN]	0.2	0.3	0.6	1.1
	R120 $V_{Rk,s,fi}$	[kN]	0.1	0.2	0.5	0.8
Steel failure with lever arm						
Characteristic resistance	R30 $M^0_{Rk,s,fi}$	[kN]	0.2	0.4	1.1	2.6
	R60 $M^0_{Rk,s,fi}$	[kN]	0.1	0.3	1.0	2.0
	R90 $M^0_{Rk,s,fi}$	[kN]	0.1	0.3	0.7	1.7
	R120 $M^0_{Rk,s,fi}$	[kN]	0.1	0.2	0.6	1.3
Concrete pryout failure						
Factor in eq. (16) of CEN/TS 1992-4-4, § 6.2.2.3	k_3	[-]	1		2	
Characteristic resistance	R30 $N_{Rk,cp,fi}$	[kN]	1.8	6.4	10.0	20.6
	R60 $N_{Rk,cp,fi}$	[kN]	1.8	6.4	10.0	20.6
	R90 $N_{Rk,cp,fi}$	[kN]	1.8	6.4	10.0	20.6
	R120 $N_{Rk,cp,fi}$	[kN]	1.5	5.1	8.0	16.5
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 TR 020.
Under fire exposure usually cracked concrete is assumed. The design equations are given in TR 020, § 2.2.2.

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 PFG anchor LB / SB / ES	
Design according to CEN/TS 1992-4 Characteristic shear resistance under fire exposure	Annex C6

Table C9: Displacements under tension loads

SORMAT PFG anchor LB / SB / ES			Anchor size			
			M6	M8	M10	M12
Non-cracked concrete C20/25 - C50/60	N	[kN]	2.0	3.6	4.8	6.3
	δ_{N0}	[mm]	0.1	0.1	0.1	0.1
	$\delta_{N\infty}$	[mm]	0.3	0.3	0.3	0.3

Table C10: Displacements under shear loads

SORMAT PFG anchor LB / SB / ES			Anchor size			
			M6	M8	M10	M12
Non-cracked concrete C20/25 - C50/60	V	[kN]	4.6	8.3	13.2	19.2
	δ_{V0}	[mm]	1.5 (+0.7)	1.9 (+1.2)	2.4 (+1.2)	3.3 (+1.2)
	$\delta_{V\infty}$	[mm]	2.3 (+0.7)	2.9 (+1.2)	3.6 (+1.2)	4.9 (+1.2)

Displacement: the table shows the deformation to be expected from the anchor itself, whilst the bracket value indicates the movement between the anchor body and the hole drilled in the concrete member or the hole in the fixture.