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Autorisé et notifié conformément à l'article 10 de la directive 89/106/EEC du Conseil, du 21 décembre 1988, relative au rapprochement des dispositions législatives, réglementaires et administratives des Etats membres concernant les produits de construction.

CSTB le futur en construction

MEMBRE DE L'EOTA

European Technical Approval ETA-05/0013

(English language translation, the original version is in French language)

Nom commercial : **Trade name:**	**Sormat LIEBIG Superplus™ A4 self-undercutting anchor**
Titulaire : **Holder of approval:**	**SORMAT OY** **Harjutie 5** **FIN-21290 Rusko** **Finlande**
Type générique et utilisation prévue du produit de construction : **Generic type and use of construction product:**	Cheville métallique autoverouillante en acier inoxydable, à expansion par vissage à couple contrôlé, de fixation dans le béton fissuré ou non fissuré : diamètres M8, M12 et M16. **Torque-controlled self undercutting anchor, made of stainless steel, for use in cracked or non-cracked concrete: sizes M8, M12 and M16.**
Validité du : au : **Validity from / to:**	**15/04/2013** **15/04/2018**
Usine de fabrication : **Manufacturing plant:**	Sormat Manufacturing Facilities
Le présent Agrément technique européen contient : **This European Technical Approval contains:**	18 pages incluant 11 annexes faisant partie intégrante du document. **18 pages including 11 annexes which form an integral part of the document.**

Cet agrément Technique Européen annule et remplace l'ATE ETA-05/0013 valide du 04/01/2011 au 01/03/2015

This European Technical Approval cancels and replaces ETA-05/0013 with validity from 04/01/2011 to 01/03/2015.

I LEGAL BASES AND GENERAL CONDITIONS

1. This European Technical Approval is issued by the Centre Scientifique et Technique du Bâtiment in accordance with:

   - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by the Council Directive 93/68/EEC of 22 July 1993[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council [3];
   - Décret n° 92-647 du 8 juillet 1992[4] concernant l'aptitude à l'usage des produits de construction;
   - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC[5];
   - Guideline for European Technical Approval of « Metal Anchors for use in Concrete » ETAG 001, edition 1997, Part 1 « Anchors in general » and Part 2 « Torque-controlled expansion anchors ».

2. The Centre Scientifique et Technique du Bâtiment is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant (for example concerning the fulfilment of assumptions made in this European Technical Approval with regard to manufacturing). Nevertheless, the responsibility for the conformity of the products with the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.

3. This European Technical Approval is not to be transferred to manufacturers or agents of manufacturer other than those indicated on page 1; or manufacturing plants other than those indicated on page 1 of this European Technical Approval.

4. This European Technical Approval may be withdrawn by the Centre Scientifique et Technique du Bâtiment pursuant to Article 5 (1) of the Council Directive 89/106/EEC.

5. Reproduction of this European Technical Approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of the Centre Scientifique et Technique du Bâtiment. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.

6. The European Technical Approval is issued by the approval body in its official language. This version corresponds to the version circulated within EOTA. Translations into other languages have to be designated as such.

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1 Official Journal of the European Communities n° L 40, 11.2.1989, p. 12
2 Official Journal of the European Communities n° L 220, 30.8.1993, p. 1
3 Official Journal of the European Union n° L 284, 31.10.2003, p. 25
4 Journal officiel de la République française du 14 juillet 1992
5 Official Journal of the European Communities n° L 17, 20.1.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1. Definition of product

The Sormat Liebig Superplus™ A4 undercutting anchor in the sizes of M8, M12 and M16 is an anchor made of stainless steel, which is placed into a drilled hole and anchored by torque-controlled expansion.

For the installed anchor see figure given in Annex 1.

1.2. Intended use

The anchor is intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106/EEC shall be fulfilled and failure of anchorages made with these products would compromise the stability of the works, cause risk to human life and/or lead to considerable economic consequences. The anchor is to be used only for anchorages subject to static or quasi-static loading in reinforced or unreinforced normal weight concrete of strength classes C 20/25 minimum to C50/60 maximum according to ENV 206: 2000-12. It may be anchored in cracked or non-cracked concrete.

The anchor 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. Such 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).

The anchor may be used for anchorages with requirements related to resistance to fire.

The provisions made in this European Technical Approval are based on an assumed intended 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.

2 Characteristics of product and methods of verification

2.1. Characteristics of product

The anchor in the sizes of M8, M12 and M16 corresponds to the drawings and provisions given in Annexes 1 to 4. The characteristic material values, dimensions and tolerances of the anchor not indicated in Annexes 2 and 3 shall correspond to the respective values laid down in the technical documentation[6] of this European Technical Approval. The characteristic anchor values for the design of anchorages are given in Annexes 5 to 8. The characteristic anchor values for the design of anchorages regarding resistance to fire are given in Annexes 9 to 11. They are valid for use in a system that is required to provide a specific fire resistance class.

Each anchor is marked with the company label and the nominal diameter of the anchor on the distance sleeve. The marking is composed of a knurl or a groove corresponding to the setting depth mark as well as the product logo the anchor type SP, the bolt diameter, the hole diameter, the embedment depth, the thickness of the connected part and A4 for stainless steel. According to Annex 1.

The anchor shall only be packaged and supplied as a complete unit.

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6 The technical documentation of this European Technical Approval is deposited at the Centre Scientifique et Technique du Bâtiment and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

In order to distinguish the different embedment depths after setting, a dot is embossed on the nut or alternatively on the top of the anchor's head for the bigger embedment depth of each size.

2.2. Methods of verification

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 has been made in accordance with the « Guideline for European Technical Approval of Metal Anchors for use in Concrete », Part 1 « Anchors in general » and Part 2 « Torque controlled expansion anchors», on the basis of Option 1.

The assessment of the anchor for the intended use in relation to the requirements for resistance to fire has been made in accordance with the Technical Report N°020 "Evaluation of anchorages in concrete concerning resistance to fire"

In addition to the specific clauses relating to dangerous substances contained in this European technical approval, there may be other 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 Evaluation of Conformity and CE marking

3.1. Attestation of conformity system

The system of attestation of conformity 2 (i) (referred to as system 1) according to Council Directive 89/106/EEC Annex III laid down by the European Commission provides:

a) tasks for the manufacturer:

1. factory production control,
2. further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan.

b) tasks for the approved body:

3. initial type-testing of the product,
4. initial inspection of factory and of factory production control,
5. continuous surveillance, assessment and approval of factory production control.

3.2. Responsibilities

3.2.1. Tasks **of** the manufacturer

3.2.1.1. Factory production control

The manufacturer shall have a factory production control system in the plant and shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. This production control system ensures that the product is in conformity with the European Technical Approval.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the prescribed test plan[7]. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of incoming materials such as nuts, washers, wire for bolts and metal band for expansion sleeves shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying dimension and determining material properties.

The frequency of controls and tests conducted during production and on the assembled anchor is laid down in the prescribed test plan taking account of the automated manufacturing process of the anchor.

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[7] The prescribed test plan has been deposited at the Centre Scientifique et Technique du Bâtiment and is only made available to the approved bodies involved in the conformity attestation procedure.

The results of factory production control are recorded and evaluated. The records shall be presented to the inspection body during the continuous surveillance. On request, they shall be presented to the Centre Scientifique et Technique du Bâtiment.

Details of the extent, nature and frequency of testing and controls to be performed within the factory production control shall correspond to the prescribed test plan which is part of the technical documentation of this European Technical Approval.

3.2.1.2. Other tasks of the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved. The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

3.2.2. Tasks of approved bodies

3.2.2.1. Initial type-testing of the product

For initial type-testing the results of the tests performed as part of the assessment for the European Technical Approval shall be used unless there are changes in the production line or plant. In such cases the necessary initial type-testing has to be agreed between the Centre Scientifique et Technique du Bâtiment and the approved bodies involved.

3.2.2.2. Initial inspection of factory and of factory production control

The approved body shall ascertain that, in accordance with the prescribed test plan, the factory and the factory production control are suitable to ensure continuous and orderly manufacturing of the anchor according to the specifications mentioned in 2.1. as well as to the Annexes to the European Technical Approval.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval.

3.2.2.3. Continuous surveillance

The approved certification body involved by the manufacturer shall visit the factory at least once a year for regular inspection. It has to be verified that the system of factory production control and the specified automated manufacturing process are maintained taking account of the prescribed test plan.

Continuous surveillance and assessment of factory production control have to be performed according to the prescribed test plan.

The results of product certification and continuous surveillance shall be made available on demand by the certification body or inspection body, respectively, to the Centre Scientifique et Technique du Bâtiment. In cases where the provisions of the European Technical Approval and the prescribed test plan are no longer fulfilled the conformity certificate shall be withdrawn.

3.3. CE-Marking

The CE marking shall be affixed on each packaging of anchors. The symbol « CE » shall be accompanied by the following information:

- Commercial name;
- Name or identifying mark of the producer and manufacturing plant;
- Name of approval body and ETA number;

- Identification number of the certification body;
- Number of the EC certificate of conformity;
- Use category (ETAG 001-2 Option 1);
- The last two digits of the year in which the CE-marking was affixed;
- Size.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1. Manufacturing

The anchor is manufactured in accordance with the provisions of the European Technical Approval using the automated manufacturing process as identified during inspection of the plant by the Centre Scientifique et Technique du Bâtiment and the approved body and laid down in the technical documentation. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to the Centre Scientifique et Technique du Bâtiment before the changes are introduced. The Centre Scientifique et Technique du Bâtiment will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alterations to the ETA shall be necessary.

4.2. Installation

4.2.1. Design of anchorages

The fitness of the anchors for the intended use is given under the following conditions:

The anchorages are designed in accordance with the « Guideline for European Technical Approval of Metal Anchors for Use in Concrete », Annex C, Method A, for torque-controlled expansion anchors under the responsibility of an engineer experienced in anchorages and concrete work.

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 (e.g. position of the anchor relative to reinforcement or to support, etc.).

The design of anchorages under fire exposure has to consider the conditions given in the Technical Report N°020 “Evaluation of anchorages in concrete concerning resistance to fire”. The relevant characteristic anchor values are given in Annex 9 & 10 for resistance to fire under tension loads and in Annex 11 for resistance to fire under shear loads. The design methods covers anchors with a fire attack from one side only. If the fire attack is from more than one side, the design method may be taken only if the edge distance of the anchor is $c \geq 300$ mm.

4.2.2. Installation of anchors

The fitness for use of the anchor can only be assumed if the anchor is installed as follows:

- 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 prepared for that purpose and using the appropriate special tools;
- thickness of the fixture corresponding to the range of required thickness values for the type of anchor;
- 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 than that of the concrete to which the characteristic loads apply;
- check of concrete being well compacted, e.g. without significant voids;

- clearing the hole of drilling dust;
- anchor installation ensuring the specified embedment depth, that is the appropriate depth marking of the anchor not exceeding the concrete surface or embedment depth control;
- keeping of the edge distance and spacing to the specified values without minus tolerances;
- positioning of the drill holes without damaging the reinforcement;
- in case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not to the anchor in the direction of load application;
- application of the torque moment given in Annex 4 using a calibrated torque wrench.

4.2.3. Responsibility of the manufacturer

It is the manufacturer's responsibility to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to as well as in sections in 4.2.1. and 4.2.2. is given to those who are concerned. This information may be made by reproduction of the respective parts of the European Technical Approval. In addition all installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

The minimum data required are:

- drill bit diameter,
- thread diameter,
- maximum thickness of the fixture,
- minimum installation depth,
- minimum hole depth,
- required torque moment,
- information on the installation procedure, including cleaning of the hole, preferably by means of an illustration,
- reference to any special installation equipment needed, identification of the manufacturing batch.

All data shall be presented in a clear and explicit form.

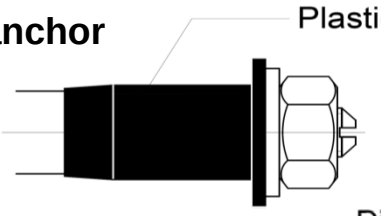
The original French version is signed by

Le Directeur Technique
C. BALOCHE

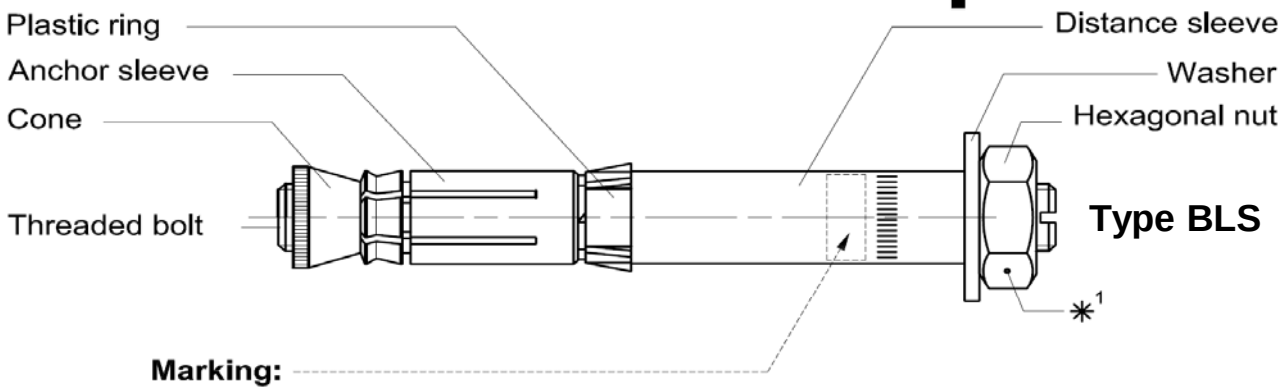
Sormat Liebig

Superplus™A4 self-undercutting anchor

Step Iron Anchor as per DIN 1211-3 / DIN 1212-3



Type SD



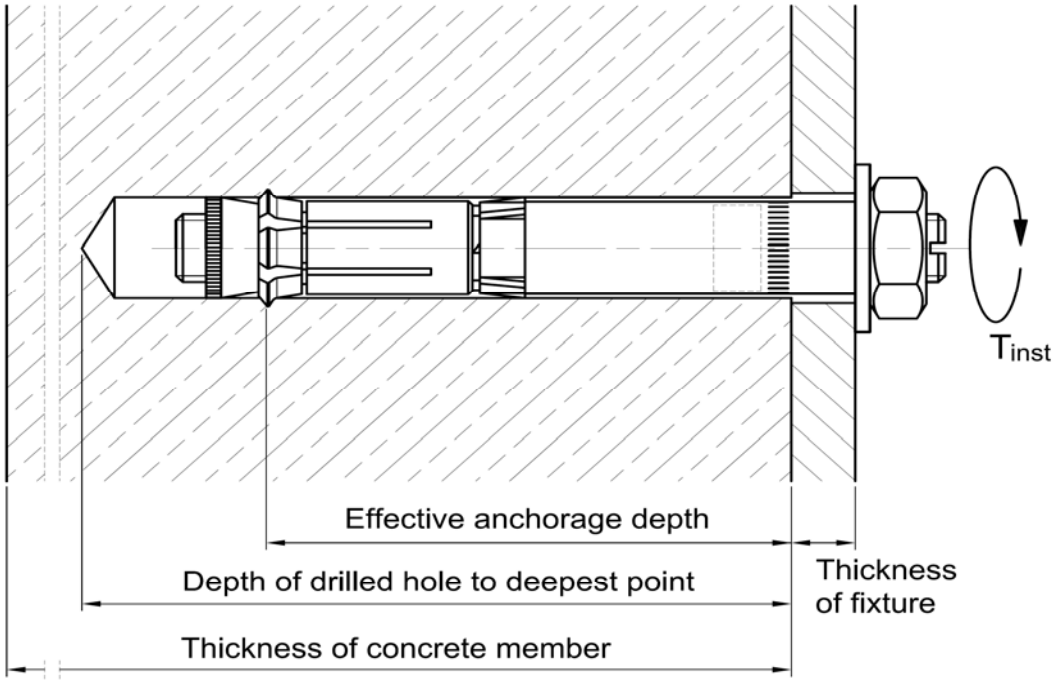
Type BLS

Marking:

Identifying mark:	⊛
Anchor identity:	for example: SP M8 14/40/15
Setting depth marking:	knurl or groove
Category:	A4
*[1] - Setting depth identification:	Embossed dot for higher depth per size (alternatively on top of threaded rod)

Sormat Liebig

Superplus™A4 self-undercutting anchor after installation



Sormat Liebig **Superplus™A4 self-undercutting anchor**	**Annex 1** of European Technical Approval
Product and intended use	

Sormat Liebig

Superplus™ A4 self-undercutting anchor

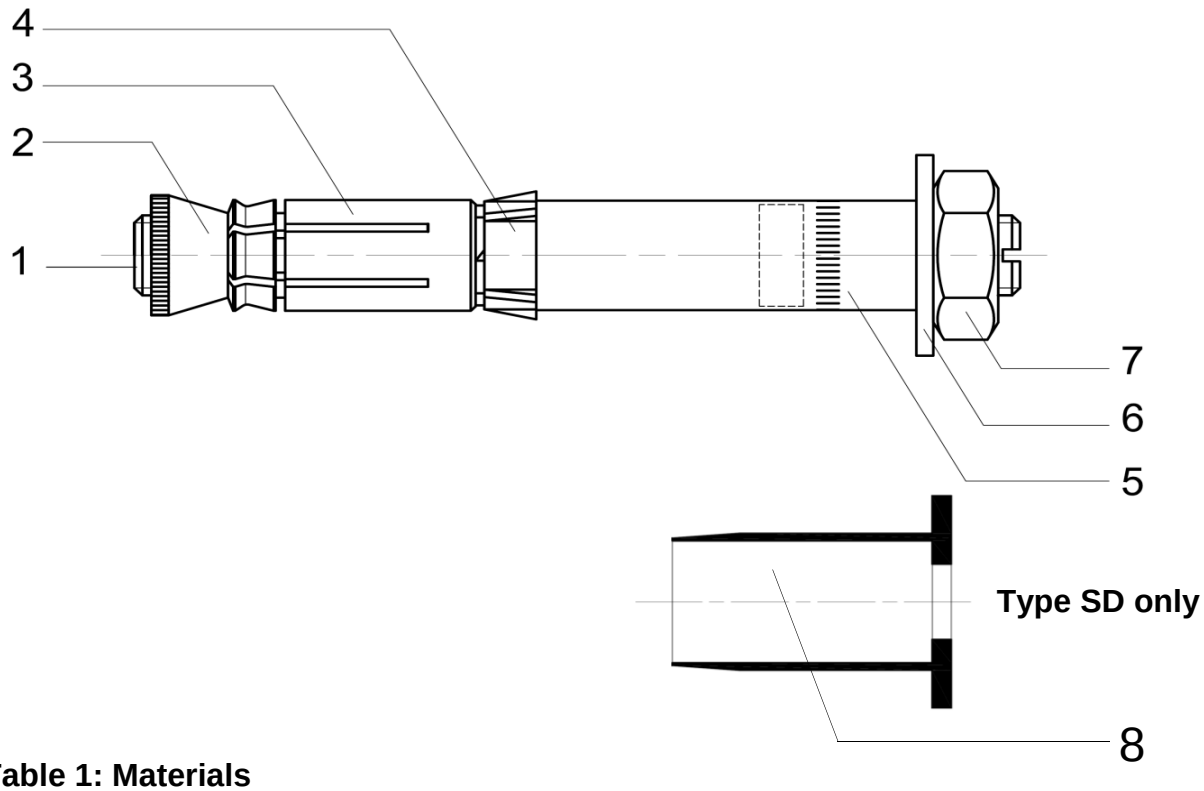


Table 1: Materials

Part	Designation	Material:
1	Threaded bolt	EN 10088: 1.4401 / 1.4404 / 1.4571 / 1.4529 EN ISO 3506-1: A4-80
2	Cone	EN 10088: 1.4401 / 1.4404 / 1.4571 / 1.4529
3	Anchor sleeve	EN 10088: 1.4401 / 1.4404 / 1.4571 / 1.4529
4	Plastic ring	PE
5	Distance sleeve	EN 10088: 1.4401 / 1.4404 / 1.4571 / 1.4529
6	Washer	EN 10088: 1.4401 / 1.4404 / 1.4571 / 1.4529
7	Hexagonal nut	EN 10088: 1.4401 / 1.4404 / 1.4571 / 1.4529 EN ISO 3506-2: A4-80
8	Plastic sleeve	PA; DIN EN ISO 1874-1

Sormat Liebig

Superplus™ A4 self-undercutting anchor

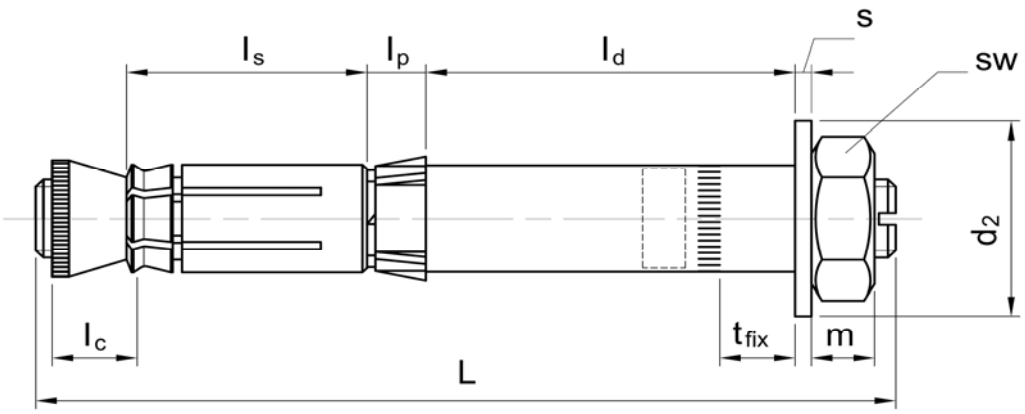


Table 2: Dimensions of the anchor

Anchor type	Main dimensions t_{fix} [mm]	Main dimensions L [mm]	Cone l_c [mm]	Anchor sleeve l_s [mm]	Plastic ring l_p [mm]	Distance sleeve l_d [mm]	Washer ≥ s [mm]	Washer ≥ d_2 [mm]	Washer d_1 [mm]	Hexagonal nut m [mm]	Hexagonal nut SW [mm]
BLS M8 - 14/40/..	0-100	65-165	11.8	26	6.0	9-109	1.5	20	8.4	6.5	≥ 16
BLS M8 - 14/80/..	0-150	105-255	11.8	26	6.0	49-199	1.5	20	8.4	6.5	≥ 16
BLS M12 - 20/80/..	0-200	115-315	16.5	40	11.5	30-230	3.5	30	13.0	10.0	22
BLS M12 - 20/150/..	0-250	185-435	16.5	40	11.5	100-350	3.5	30	13.0	10.0	22
BLS M16 - 25/150/..	0-250	190-440	17.8	60	11.5	80-330	4.0	40	17.0	13.0	27
BLS M16 - 25/200/..	0-300	240-540	17.8	60	11.5	130-430	4.0	40	17.0	13.0	27

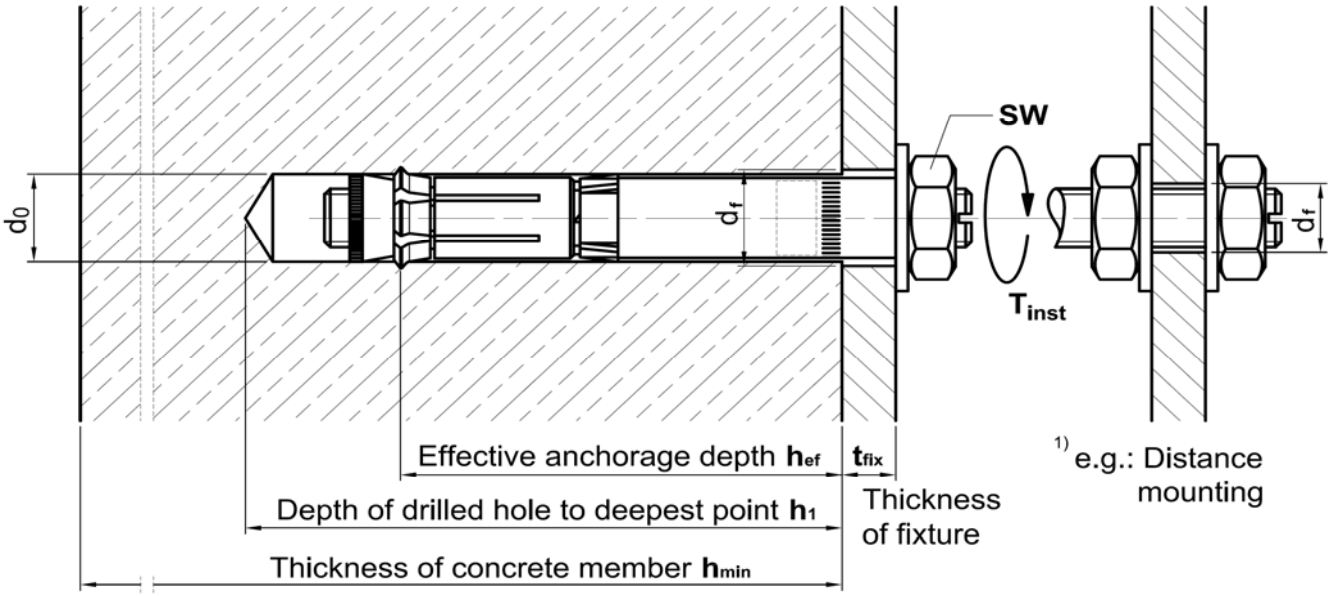


Table 3: Installation data

Sormat Liebig Superplus™ A4				Anchor type					
				BLS M8 - 14		BLS M12 - 20		BLS M16 - 25	
				/40/..	/80/..	/80/..	/150/..	/150/..	/200/..
Drill hole diameter		d_o	[mm]	14		20		25	
Cutting diameter at the upper tolerance limit (maximum diameter bit)		$d_{cut,max} \leq$	[mm]	14.50		20.55		25.55	
Depth of drilled hole to deepest point		$h_1 \geq$	[mm]	60	100	105	175	185	235
Effective anchorage depth		$h_{ef} \geq$	[mm]	40	80	80	150	150	200
Diameter of clearance hole in the fixture	In-place anchorage	$d_f \leq$	[mm]	16		21		26	
	Mounting on the threaded bolt [1]	$d_f \leq$	[mm]	10		14		18	
Thickness of fixture		t_{fix}	[mm]	0-100	0-150	0-200	0-250	0-250	0-300
Width across flats		SW	[mm]	≥ 16		22		27	
Torque moment		T_{inst}	[Nm]	25		80		180	

Table 4: Minimum thickness of concrete member, center spacing and edge distance

Sormat Liebig Superplus™ A4			Anchor type					
			BLS M8 - 14		BLS M12 - 20		BLS M16 - 25	
			/40/..	/80/..	/80/..	/150/..	/150/..	/200/..
Minimum thickness of concrete member	h_{min}	[mm]	100	160	160	300	300	400
Minimum allowable spacing	s_{min}	[mm]	80	80	150	150	150	180
Minimum allowable edge distance	c_{min}	[mm]	60	50	100	80	100	100

Sormat Liebig
Superplus™ A4 self-undercutting anchor

Installation data

Annex 4

of European Technical Approval
ETA-05/0013

Table 5: Characteristic values of resistance to tensile loads and partial safety factors for material according to design method A

Sormat Liebig Superplus™ A4			Anchor type					
			BLS M8 - 14		BLS M12 - 20		BLS M16 - 25	
			/40/..	/80/..	/80/..	/150/..	/150/..	/200/..
Steel failure								
Characteristic resistance	$N_{Rk,s}$	[kN]	29.3		67.4		125.6	
Partial safety factor	γ_{Ms}	[-]	1.6 [1)]					
Pull-out failure								
Characteristic resistance in **cracked** concrete C20/25	$N_{Rk,p}$	[kN]	9	12	25	40	60	60
Characteristic resistance in **non-cracked** concrete C20/25	$N_{Rk,p}$	[kN]	not decisive failure mode					
Increasing factor for $N_{Rk,p}$	Ψ_C	C30/37	1.22					
		C40/50	1.41					
		C50/60	1.55					
Partial safety factor	γ_{Mp}	[-]	1.5 [1)]					
Concrete cone failure and splitting failure								
Characteristic resistance in **cracked** concrete C20/25	$N^0_{Rk,c}$ [2)]	[kN]	9.1	25.8	25.8	66.1	66.1	101.8
Characteristic resistance in **non-cracked** concrete C20/25	$N^0_{Rk,c}$ [2)]	[kN]	12.8	36.1	36.1	92.6	92.6	142.5
Increasing factor for $N^0_{Rk,c}$	Ψ_C	C30/37	1.22					
		C40/50	1.41					
		C50/60	1.55					
Effective anchorage depth	h_{ef}	[mm]	40	80	80	150	150	200
Center Spacing	$s_{cr,N}$	[mm]	120	240	240	450	450	600
Edge distance	$c_{cr,N}$	[mm]	60	120	120	225	225	300
Center Spacing (splitting)	$s_{cr,sp}$	[mm]	140	360	360	540	560	560
Edge distance (splitting)	$c_{cr,sp}$	[mm]	70	180	180	270	280	280
Partial safety factor	$\gamma_{Mc} = \gamma_{Msp}$	[-]	1.5 [1)]					

[1)] In absence of other national regulations

[2)] Characteristic resistance values for the evaluation of one single anchor without influence of spacings ($s \geq s_{cr,N}$) or edge distances ($c \geq c_{cr,N}$). For evaluation of groups of anchors ($s < s_{cr,N}$) or anchors close to edges ($c < c_{cr,N}$), equation (5.2) of ETAG 001, part C has to be taken into account.

Table 6: Displacements under tensile loads

Anchor type	Displacements and tensile loads in C20/25 to C50/60											
	Cracked concrete						Non-cracked concrete					
	C20/25			C50/60			C20/25			C50/60		
	N [kN]	d_{N0} [mm]	$d_{N\infty}$ [mm]	N [kN]	d_{N0} [mm]	$d_{N\infty}$ [mm]	N [kN]	d_{N0} [mm]	$d_{N\infty}$ [mm]	N [kN]	d_{N0} [mm]	$d_{N\infty}$ [mm]
BLS M8 - 14/40/..	3.6	0.3	1.1	5.5	0.3	1.1	3.4	0.2	0.6	5.5	0.1	0.6
BLS M8 - 14/80/..	5.7	0.5	1.7	5.7	0.5	1.7	13.9	2.0	2.0	13.9	2.0	2.0
BLS M12 - 20/80/..	9.9	0.5	0.9	15.4	0.7	0.9	14.3	0.4	0.6	32.1	1.0	1.0
BLS M12 - 20/150/..	15.9	0.9	1.4	15.4	0.7	1.4	32.1	3.8	3.8	32.1	1.0	1.0
BLS M16 - 25/150/..	23.8	0.9	1.4	36.9	1.4	1.4	36.7	0.7	0.7	59.8	3.4	3.4
BLS M16 - 25/200/..	23.8	1.2	1.6	36.9	1.4	1.6	59.8	5.0	5.0	59.8	3.4	3.4

Table 7: Characteristic values of resistance to shear loads and partial safety factors for material according to design method A

Sormat Liebig Superplus™ A4			Anchor type					
			BLS M8 - 14		BLS M12 - 20		BLS M16 - 25	
			/40/..	/80/..	/80/..	/150/..	/150/..	/200/..
Steel failure without lever arm								
Characteristic resistance for In-place anchorage	$V_{Rk,s}$	[kN]	44.6		90.3		168.9	
Partial safety factor	γ_{Ms}	[-]	1.33 [1)]					
Steel failure with lever arm								
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	30		105		266	
Partial safety factor	γ_{Ms}	[-]	1.33 [1)]					
Concrete pryout failure								
Factor in equation (5.6) of ETAG Annex C, § 5.2.3.3	k	[-]	1	2	2		2	
Partial safety factor	γ_{Mc}	[-]	1.5 [1)]					
Concrete edge failure								
Effective length of anchor under shear load	ℓ_f	[mm]	40	80	80	150	150	200
Outside diameter of anchor	d_{nom}	[mm]	14		20		25	
Cracked concrete without any edge reinforcement	$\Psi_{ucr,V}$	[-]	1.00					
Cracked concrete with straight edge reinforcement > Ø12 mm			1.20					
Cracked concrete with edge reinforcement and closely spaced stirrups (a≤100mm) or **non cracked concrete**			1.40					
Partial safety factor	γ_{Mc}	[-]	1.5 [1)]					

[1)] In absence of other national regulations

Table 8: Displacements under shear loads

Anchor type	Displacements and shear loads in C20/25 to C50/60					
	Cracked concrete			Non-cracked concrete		
	C20/25 - C50/60			C20/25 - C50/60		
	V	d_{V0}	$d_{V\infty}$	V	d_{V0}	$d_{V\infty}$
	[kN]	[mm]	[mm]	[kN]	[mm]	[mm]
BLS M8 - 14/40/..	25.5	6.3 (+1.7)	9.5 (+1.7)	25.5	6.3 (+1.7)	9.5 (+1.7)
BLS M8 - 14/80/..	25.5	6.3 (+1.7)	9.5 (+1.7)	25.5	6.3 (+1.7)	9.5 (+1.7)
BLS M12 - 20/80/..	51.6	8.0 (+1.7)	12.0 (+1.7)	51.6	8.0 (+1.7)	12.0 (+1.7)
BLS M12 - 20/150/..	51.6	8.0 (+1.7)	12.0 (+1.7)	51.6	8.0 (+1.7)	12.0 (+1.7)
BLS M16 - 25/150/..	96.5	8.8 (+1.7)	13.2 (+1.7)	96.5	8.8 (+1.7)	13.2 (+1.7)
BLS M16 - 25/200/..	96.5	8.8 (+1.7)	13.2 (+1.7)	96.5	8.8 (+1.7)	13.2 (+1.7)

( ): Values indicate the additional displacement caused by the movement between the anchor's body and the hole in the concrete or the hole in the fixture.

Sormat Liebig
Superplus™ A4 self-undercutting anchor

Design method A: Characteristic values of tension load resistance under fire exposure

Annex 9
of European Technical Approval
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Table 9: Characteristic tension resistance in cracked and non-cracked concrete C20/25 to C50/60 under fire exposure according to design method A

Sormat Liebig Superplus™ A4		BLS M8 - 14/40/..				BLS M12 - 20/80/..				BLS M16 - 25/150/..			
Fire resistance duration	**R… [min]**	**30**	**60**	**90**	**120**	**30**	**60**	**90**	**120**	**30**	**60**	**90**	**120**
Steel failure													
Characteristic resistance	$N_{Rk,s,fi}$ [kN]	0.73	0.59	0.44	0.37	2.5	2.1	1.7	1.3	4.7	3.9	3.1	2.5
Pull-out failure													
Characteristic resistance	$N_{Rk,p,fi}$ [kN]	2.3			1.8	6.3			5.0	15.0			12.0
Concrete cone failure													
Characteristic resistance	$N^0_{Rk,c,fi}$ [kN]	1.8			1.5	10.3			8.2	49.6			39.7
Spacing	$s_{cr,N}$ [mm]	4 x h_{ef}											
	s_{min} [mm]	80				150				150			
Edge distance	$c_{cr,N}$ [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 $\geq$ 2 x h_{ef}											

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1.0 is recommended.

Table 9: Characteristic tension resistance in cracked and non-cracked concrete C20/25 to C50/60 under fire exposure according to design method A

Sormat Liebig Superplus™ A4		BLS M8 - 14/ 80/ ..				BLS M12 - 20/150/ ..				BLS M16 - 25/200/ ..			
Fire resistance duration	**R… [min]**	**30**	**60**	**90**	**120**	**30**	**60**	**90**	**120**	**30**	**60**	**90**	**120**
Steel failure													
Characteristic resistance	$N_{Rk,s,fi}$ [kN]	0.73	0.59	0.44	0.37	2.5	2.1	1.7	1.3	4.7	3.9	3.1	2.5
Pull-out failure													
Characteristic resistance	$N_{Rk,p,fi}$ [kN]	3.0			2.4	10.0			8.0	15.0			12.0
Concrete cone failure													
Characteristic resistance	$N^0_{Rk,c,fi}$ [kN]	10.3			8.2	49.6			39.7	101.8			81.5
Spacing	$s_{cr,N}$ [mm]	$4 \times h_{ef}$											
	s_{min} [mm]	80				150				180			
Edge distance	$c_{cr,N}$ [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 $\geq 2 \times h_{ef}$											

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1.0$ is recommended.

Table 10: Characteristic shear resistance in cracked and non-cracked concrete C20/25 to C50/60 under fire exposure according to design method A

Sormat Liebig Superplus™ A4		BLS M8				BLS M12				BLS M16			
Fire resistance duration	**R… [min]**	**30**	**60**	**90**	**120**	**30**	**60**	**90**	**120**	**30**	**60**	**90**	**120**
Steel failure without lever arm													
Characteristic resistance	$V_{Rk,s,fi}$ [kN]	0.73	0.59	0.44	0.37	2.5	2.1	1.7	1.3	4.7	3.9	3.1	2.5
Steel failure with lever arm													
Characteristic bending moment	$M^0_{Rk,s,fi}$ [Nm]	0.75	0.60	0.45	0.38	3.9	3.3	2.6	2.1	9.9	8.3	6.6	5.3
Concrete pry-out failure		**BLS M8 - 14/40/..**				**BLS M12 - 20/80/..**				**BLS M16 - 25/150/..**			
Factor in equation (5.6) of ETAG 001 Annex C, 5.2.3.3	k [-]	1				2							
Characteristic resistance	$V^0_{Rk,cp,fi}$ [kN]	1.8			1.5	20.6			16.4	99.2			79.4
Concrete pry-out failure		**BLS M8 - 14/80/..**				**BLS M12 - 20/150/..**				**BLS M16 - 25/200/..**			
Factor in equation (5.6) of ETAG 001 Annex C, 5.2.3.3	k [-]	2											
Characteristic resistance	$V^0_{Rk,cp,fi}$ [kN]	20.6			16.4	99.2			79.4	203.6			163.0
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 is determined by: $V^0_{Rk,c,fi}$ 0,25 x $V^0_{Rk,c}$ (≤ R90) $V^0_{Rk,c,fi}$ = 0,20 x $V^0_{Rk,c}$ (R120) with $V^0_{Rk,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature.													

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1.0 is recommended.