

European Technical Approval ETA-04/0098

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung
Trade name

Sormat Liebig® Ultraplus™ A4 Hinterschneidanker
Sormat Liebig® Ultraplus™ A4 undercut anchor

Zulassungsinhaber
Holder of approval

Sormat Oy
Harjutie 5
21290 RUSKO
FINNLAND

Zulassungsgegenstand
und Verwendungszweck

*Generic type and use
of construction product*

Hinterschnittdübel aus nichtrostendem Stahl in den Größen
M10, M12, M16 und M20 zur Verankerung im Beton
*Undercut anchor made of stainless steel of sizes
M10, M12, M16 and M20 for use in concrete*

Geltungsdauer:
Validity:

vom
from
bis
to

9 April 2013

9 April 2018

Herstellwerk
Manufacturing plant

Sormat Plant 1

Diese Zulassung umfasst
This Approval contains

18 Seiten einschließlich 11 Anhänge
18 pages including 11 annexes

Diese Zulassung ersetzt
This Approval replaces

ETA-04/0098 mit Geltungsdauer vom 27.04.2011 bis 18.02.2015
ETA-04/0098 with validity from 27.04.2011 to 18.02.2015

I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik 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 products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998⁴, as amended by Article 2 of the law of 8 November 2011⁵;*
 - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁶;
 - Guideline for European technical approval of "Metal anchors for use in concrete - Part 3: Undercut anchors", ETAG 001-03.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to 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 manufacturers 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 Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of 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 Deutsches Institut für Bautechnik. 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 fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

1 Official Journal of the European Communities L 40, 11 February 1989, p. 12
2 Official Journal of the European Communities L 220, 30 August 1993, p. 1
3 Official Journal of the European Union L 284, 31 October 2003, p. 25
4 *Bundesgesetzblatt Teil I 1998*, p. 812
5 *Bundesgesetzblatt Teil I 2011*, p. 2178
6 Official Journal of the European Communities L 17, 20 January 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® Ultraplus™ A4 undercut anchor of sizes M10, M12, M16 and M20 is an anchor made of stainless steel which is placed in an undercut hole and anchored by mechanical interlock with displacement-controlled installation.

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 cause risk to human life and/or lead to considerable economic consequences.

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

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 C20/25 at minimum and C50/60 at most according to EN 206:2000-12.

It may be anchored in cracked and non-cracked concrete.

The anchor may be used in structures subject to dry internal conditions and also in structures 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 provisions made in this European technical approval 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.

2 Characteristics of product and methods of verification

2.1 Characteristics of product

The anchor corresponds to the drawings and provisions given in Annexes 2 and 3. 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 documentation⁷ of this European technical approval.

Regarding the requirements concerning safety in case of fire it is assumed that the anchor meets the requirements of class A1 in relation to reaction to fire in accordance with the stipulations of the Commission decision 96/603/EC, amended by 2000/605/EC.

⁷ The technical documentation of this European technical approval is deposited at the Deutsches Institut für Bautechnik 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.

The characteristic values for the design of anchorages are given in Annexes 4 to 6.

The characteristic values for the design of anchorages regarding resistance to fire are given in the Annexes 7 and 8. They are valid for use in a system that is required to provide a specific fire resistance class.

Each anchor shall be marked with the identifying mark of the producer, the commercial name, the maximum thickness of fixture, the letter A4 for stainless steel and the setting depth according to Annex 1.

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

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 3 "Undercut 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 TR 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 System of attestation of conformity

According to the decision 96/582/EG of the European Commission⁸ the system 2(i) (referred to as system 1) of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

- (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 control 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.

Note: Approved bodies are also referred to as "notified bodies".

⁸ Official Journal of the European Communities L 254 of 8.10.1996.

3.2 Responsibilities

3.2.1 Tasks of the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use initial / raw / constituent materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan of November 2009 which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Deutsches Institut für Bautechnik⁹.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

3.2.1.2 Other tasks of 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 anchors in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 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

The approved body shall perform the

- initial type-testing of the product ,
 - initial inspection of factory and of factory production control,
 - continuous surveillance, assessment and approval of factory production control,
- in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

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.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

⁹

The control plan is a confidential part of the documentation of the European technical approval, but not published together with the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity.
See section 3.2.2.

3.3 CE marking

The CE marking shall be affixed on each packaging of the anchor. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacturer),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European technical approval,
- the number of the guideline for European technical approval
- use category (ETAG 001-1 Option 1),
- size.

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

4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the European technical approval and consequently the validity of the CE marking on the basis of the European technical approval and if so whether further assessment or alterations to the European technical approval shall be necessary.

4.2 Design of anchorages

The fitness of the anchor 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 undercut 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 supports, in cracked or non-cracked concrete, etc.).

The design of anchorages under fire exposure has to consider the conditions given in the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire". The relevant characteristic anchor values are given in Annexes 7 and 8. The design method 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.

4.3 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 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 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 than that of the concrete to which the characteristic loads apply,
- Check of concrete being well compacted, e.g. without significant voids,
- Edge distances and spacings not less than 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 in the direction of load application,
- Clearing of the hole of drilling dust,
- Anchor installation such that the effective anchorage depth is complied with. This compliance is ensured, if the thickness of fixture is not greater than the maximum thickness of fixture marked on the anchor,
- Application of the required torque moment given in Annex 4 using a calibrated torque wrench.

5 Responsibility of the manufacturer

It is in the responsibility of the manufacturer to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to as well as sections 4.2 and 4.3 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:

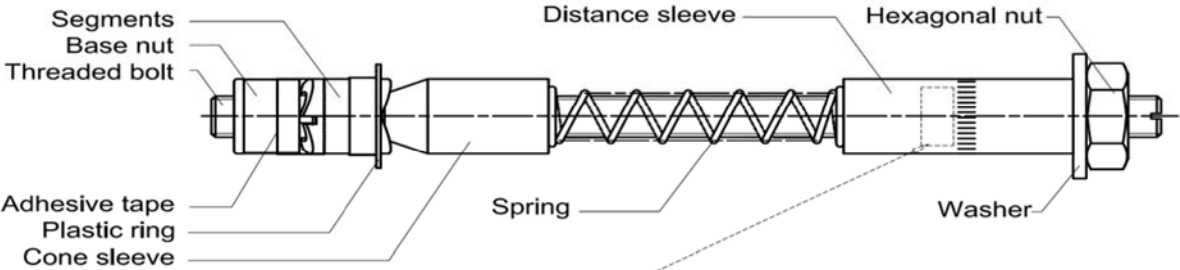
- Drill bit (corresponding special drill bit),
- Maximum thickness of the fixture,
- Minimum effective anchorage depth,
- Minimum Hole depth,
- Maximum Torque moment,
- Information on the installation procedure, including cleaning of the hole, preferably by means of an illustration,
- Setting tools,
- Identification of the manufacturing batch.


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

Georg Feistel
Head of Department

beglaubigt:
Baderschneider

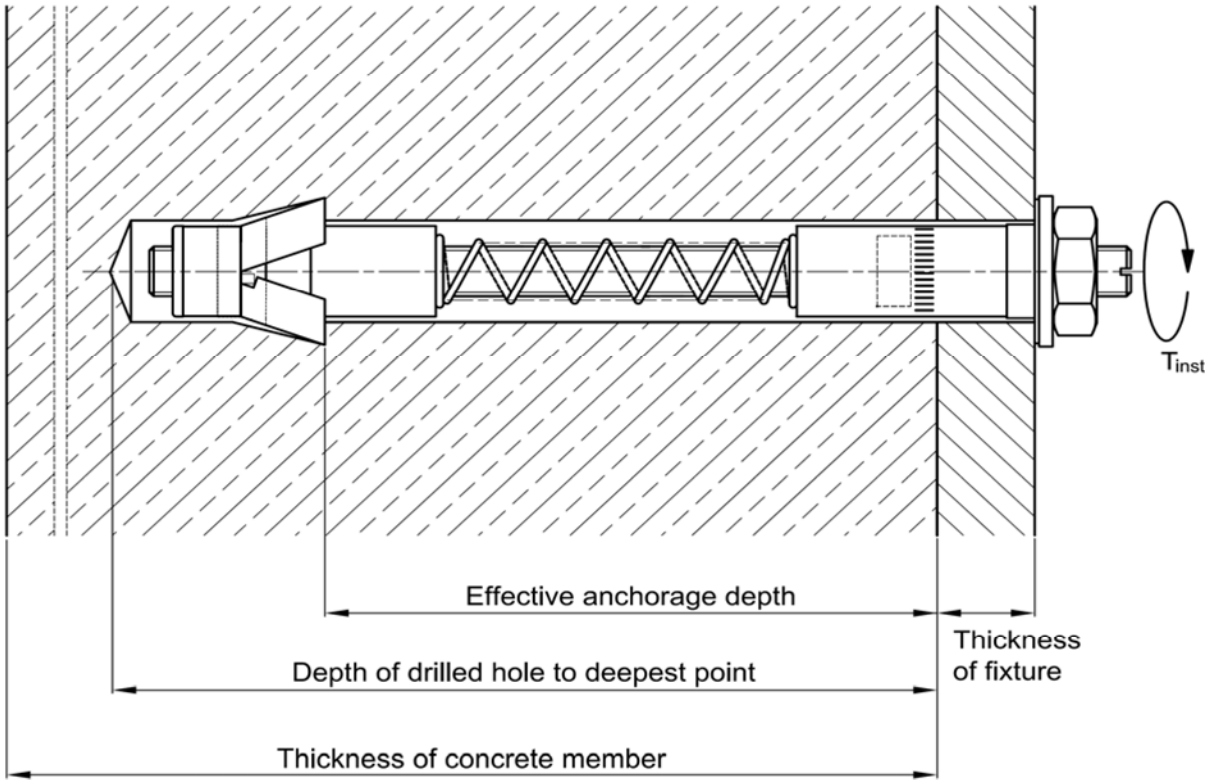
Sormat Liebig Ultraplus™ A4 undercut anchor



Marking: Identifying mark: 
Trade name: UP
Thread size: M ..
max. thickness of fixture: t_{fix}
Category: A4
Setting depth marking: knurl or groove

for example: UP M12/20 A4

Sormat Liebig Ultraplus™ A4 after installation



Sormat Liebig® Ultraplus™ A4 undercut anchor

Product and intended use

Annex 1

Sormat Liebig Ultraplus™ A4 undercut anchor

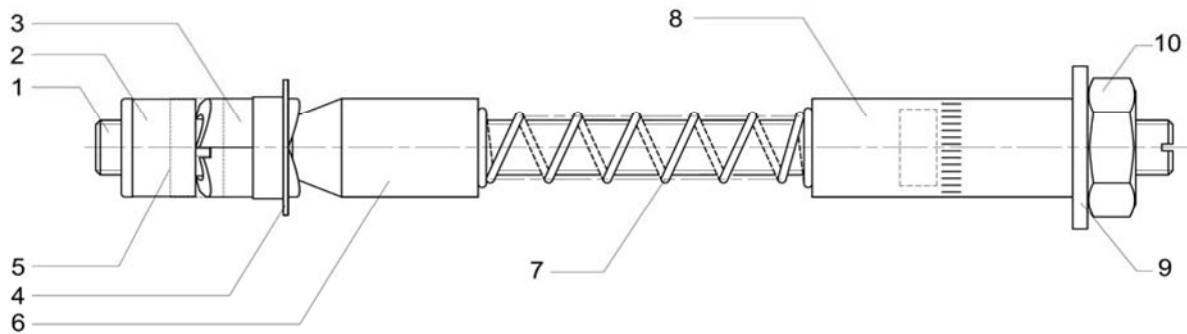


Table 1: Materials

Part	Designation	Material: stainless steel
1	Threaded Bolt	EN 10088: 1.4401 / 1.4404 / 1.4571 EN ISO 3506-1: A4-80
2	Base Nut	EN 10088: 1.4401 / 1.4404 / 1.4571
3	Segment	EN 10088: 1.4401 / 1.4404 / 1.4571 EN 10283: 1.4408 / 1.4409 / 1.4581
4	Plastic Ring	PE
5	Adhesive Tape	according to specifications
6	Cone Sleeve	EN 10088: 1.4401 / 1.4404 / 1.4571
7	Spring	EN 10270-3: 1.4310 / 1.4568 / 1.4571
8	Distance Sleeve	EN 10088: 1.4401 / 1.4404 / 1.4571
9	Washer	EN 10088: 1.4401 / 1.4404 / 1.4571
10	Hexagonal Nut ¹⁾	EN 10088: 1.4401 / 1.4404 / 1.4571 EN ISO 3506-2: A4-80

¹⁾ lubrication

Sormat Liebig® Ultraplus™ A4 undercut anchor

Materials

Annex 2

Sormat Liebig Ultraplus™ A4 undercut anchor

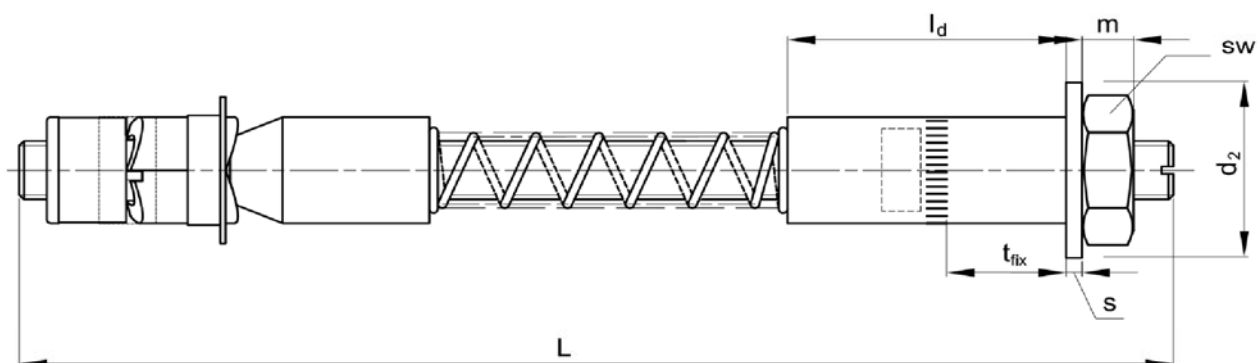


Table 2: Dimensions of the anchor

Main dimensions			Distance sleeve	Hexagonal nut		Washer		
Anchor size	L [mm]	t _{fix} [mm]	l _d [mm]	m [mm]	SW [mm]	d ₂ [mm]	d ₁ [mm]	s [mm]
UP M10	160...360	0...200	35...235	8	22	27	10.2	2.5
UP M12	200...400	0...200	40...240	10	24	32	12.2	3.5
UP M16	295...495	0...200	40...240	13	36	48	16.2	4.0
UP M20	330...530	0...200	40...240	16	41	50	20.2	5.0

Sormat Liebig® Ultraplus™ A4 undercut anchor

Dimensions of the anchor

Annex 3

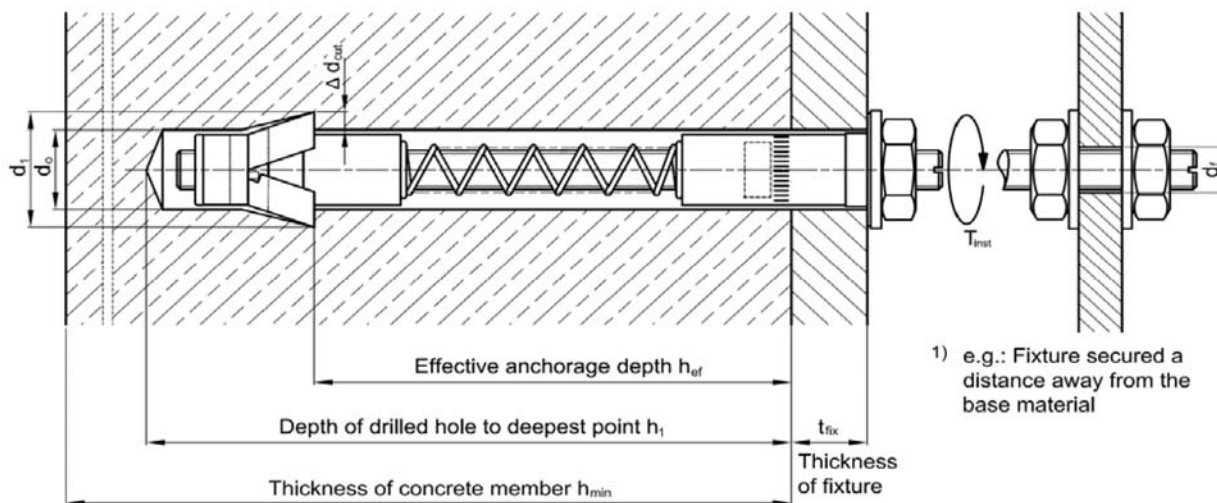


Table 3: Installation data

Sormat Liebig Ultraplus™ A4			UP M10	UP M12	UP M16	UP M20
Drill hole diameter	d_0	[mm]	19	23	30	36
Cutting diameter at the upper tolerance limit (maximum diameter bit)	$d_{cut,max} \leq$	[mm]	19.5	23.55	30.55	36.7
Undercutting	Δd_{cut}	[mm]	4.25	6	8.5	8.75
Diameter of undercutting hole	d_1	[mm]	27.5	35	47	53.5
Depth of drilled hole to deepest point	$h_1 \geq$	[mm]	150	190	300	330
Effective anchorage depth	$h_{ef} \geq$	[mm]	110	140	220	250
Diameter of clearance hole in the fixture	In-place anchorage	$d_f \leq$	20	24	32	38
	Mounting on the threaded bolt ¹⁾	$d_f \leq$	12	14	18	22
Thickness of fixture	$t_{fix} \leq$	[mm]	50	60	70	100
Width across flats	SW	[mm]	22	24	36	41
Torque moment	T_{inst}	[Nm]	45	80	250	300

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

Sormat Liebig Ultraplus™ A4			UP M10	UP M12	UP M16	UP M20
Minimum thickness of concrete member	h_{min}	[mm]	200	240	360	400
Minimum thickness of concrete member... ²⁾	h_{min}	[mm]	-	-	330	360
Minimum spacing	s_{min}	[mm]	110	140	220	250
Minimum edge distance	c_{min}	[mm]	110	140	220	250

²⁾ only where the remote face of the concrete member is inspected to ensure there has been no break-through.

Sormat Liebig® Ultraplus™ A4 undercut anchor

Installation data,
Minimum thickness of concrete member,
Spacing and edge distance

Annex 4

Table 5: Characteristic values of resistance to tensile loads - Design method A

Sormat Liebig Ultraplus™ A4			UP M10	UP M12	UP M16	UP M20
Steel failure						
Characteristic resistance	$N_{Rk,s}$	[kN]	46	67	126	196
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1.6			
Pullout failure						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	25	40	75	95
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	35	60	95	140
Increasing factor for $N_{Rk,p}$	Ψ_C	C30/37	1.22			
		C40/50	1.41			
		C50/60	1.55			
Partial safety factor	$\gamma_{Mc}^{1)}$	[-]	1.5 ²⁾			
Concrete cone failure and splitting failure						
Effective anchorage depth	h_{ef}	[mm]	110	140	220	250
Center Spacing	$s_{cr,N}$	[mm]	330	420	660	750
Edge distance	$c_{cr,N}$	[mm]	165	210	330	375
Center Spacing (splitting)	$s_{cr,sp}$	[mm]	330	420	660	750
Edge distance (splitting)	$c_{cr,sp}$	[mm]	165	210	330	375
Partial safety factor	$\gamma_{Mc} = \gamma_{M,sp}^{1)}$	[-]	1.5 ²⁾			

¹⁾ In absence of other national regulations

²⁾ The installation safety factor $\gamma_2 = 1.0$ is included

Table 6: Displacements under tensile loads

Sormat Liebig Ultraplus™ A4		UP M10	UP M12	UP M16	UP M20
Displacements and tensile loads in C20/25 to C50/60					
Cracked concrete	N [kN]	9.9	15.9	29.8	37.7
	δ_{N0} [mm]	0.7	0.8	1.1	1.4
	$\delta_{N\infty}$ [mm]	1.8	1.8	1.8	1.8
Non-cracked concrete	N [kN]	13.9	23.8	37.7	55.6
	δ_{N0} [mm]	1.3	1.3	1.3	1.3
	$\delta_{N\infty}$ [mm]	2.5	2.5	2.5	2.5

Sormat Liebig® Ultraplus™ A4 undercut anchor

Design method A:
Characteristic values of tension loads,
Displacements

Annex 5

Table 7: Characteristic values of resistance to shear loads - Design method A

Sormat Liebig Ultraplus™ A4			UP M10	UP M12	UP M16	UP M20
Steel failure without lever arm						
Characteristic resistance for In-place anchorage	$V_{Rk,s}$	[kN]	55	90	160	230
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1.33			
Steel failure with lever arm						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	60	105	266	519
Partial safety factor	$\gamma_{Ms}^{1)}$	[-]	1.33			
Concrete pryout failure						
Factor in equation (5.6) of ETAG Annex C, 5.2.3.3	k	[-]	2			
Partial safety factor	$\gamma_{Mc}^{1)}$	[-]	1.5 ²⁾			
Concrete edge failure						
Effective length of anchor under shear load	ℓ_f	[mm]	110	140	220	250
Outside diameter of anchor	d_{nom}	[mm]	17.5	21.7	25	25
Partial safety factor	$\gamma_{Mc}^{1)}$	[-]	1.5 ²⁾			

¹⁾ In absence of other national regulations

²⁾ The installation safety factor $\gamma_2 = 1.0$ is included

Table 8: Displacements under shear loads

Sormat Liebig Ultraplus™ A4		UP M10	UP M12	UP M16	UP M20
Displacements and shear loads in C20/25 to C50/60					
Cracked and non-cracked concrete	V [kN]	29.5	48.3	85.9	123.5
	δ_{V0} [mm]	2.4	3.2	4.5	5.1
	$\delta_{V\infty}$ [mm]	3.6	4.8	6.7	7.6

Sormat Liebig® Ultraplus™ A4 undercut anchor

Design method A:
Characteristic values of shear loads,
Displacements

Annex 6

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

Sormat Liebig Ultraplus™ A4		UP M10			UP M12			UP M16			UP M20						
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]	1.4	1.2	0.9	0.8	2.5	2.1	1.7	1.3	4.7	3.9	3.1	2.5	7.3	6.1	4.9	3.9
Pull-out failure																	
Characteristic resistance	N _{Rk,p,fi} [kN]	6.3			5	10	8	18.8	15	23.8	19						
Concrete cone failure																	
Characteristic resistance	N ⁰ _{Rk,c,fi} [kN]	22.8		18.3	41.7	33.4	117.5	103.4	142.3								
Spacing	s _{cr,N} [mm]	4 x h _{ef}															
	s _{min} [mm]	110			140			220			250						
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} ≥ 300 mm and ≥ 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.

Sormat Liebig® Ultraplus™ A4 undercut anchor

Annex 7

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

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

Sormat Liebig Ultraplus™ A4		UP M10			UP M12			UP M16			UP M20						
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]	1.4	1.2	0.9	0.8	2.5	2.1	1.7	1.3	4.7	3.9	3.1	2.5	7.3	6.1	4.9	3.9
Steel failure with lever arm																	
Characteristic bending moment	$M^0_{Rk,s,fi}$ [Nm]	1.9	1.5	1.2	1.0	3.9	3.3	2.6	2.1	9.9	8.3	6.6	5.3	19.5	16.2	13.0	10.4
Concrete pry-out failure																	
Factor in equation (5.6) of ETAG 001 Annex C, 5.2.3.3	k [-]	2															
Characteristic resistance	$V^0_{Rk,cp,fi}$ [kN]	45.6	36.6	83.4	66.8	235.0	206.8	284.6									
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: $V^0_{Rk,c,fi} 0,25 \times V^0_{Rk,c} \ (\leq R90)$ $V^0_{Rk,c,fi} = 0,20 \times V^0_{Rk,c} \ (R120)$ with $V^0_{Rk,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature.																	

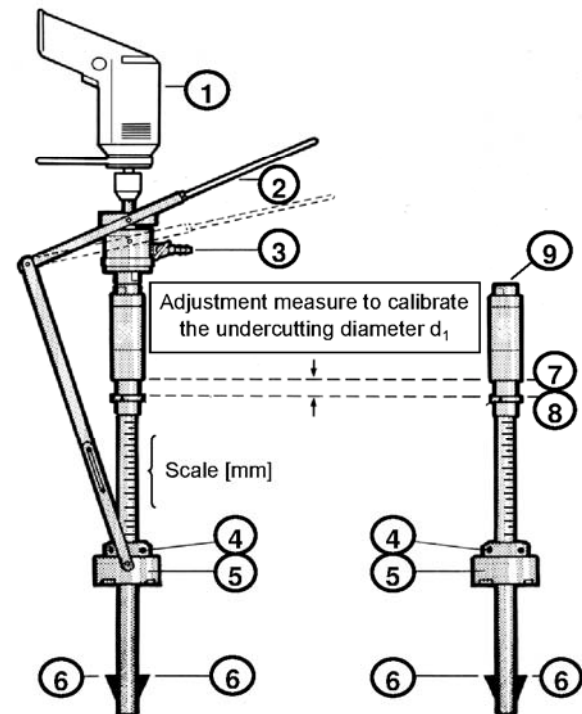
In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1.0$ is recommended.

Sormat Liebig® Ultraplus™ A4 undercut anchor

Design method A:
Characteristic values of shear resistance under fire exposure

Annex 8

Sormat Liebig Ultraplus™ undercutting tool

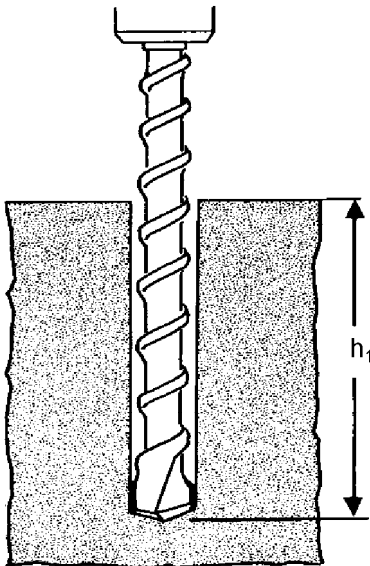


Hand undercutting tool
Type DH

Undercutting tool for core drilling rigs
Type D

1	Drilling machine, rated input ≥ 1000 W
2	Hand lever
3	Water supply
4	Hexagon socket screws
5	Embedment depth gauge
6	Diamond cutting blades
7	Undercutting gauge
8	Depth gauge
9	1/2" connector

1. Drill hole



Type	Depth of drilled hole h_1
UP M10-19/110/..	150 mm
UP M12-23/140/..	190 mm
UP M16-30/220/..	300 mm
UP M20-36/250/..	330 mm

- Drill cylindrical hole with rotary hammer or a diamond drilling machine (core drilling).
- Remove drilling dust.

Sormat Liebig® Ultraplus™ A4 undercut anchor

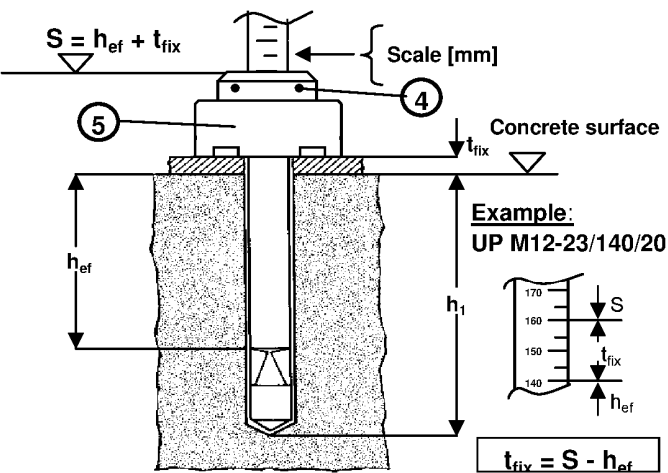
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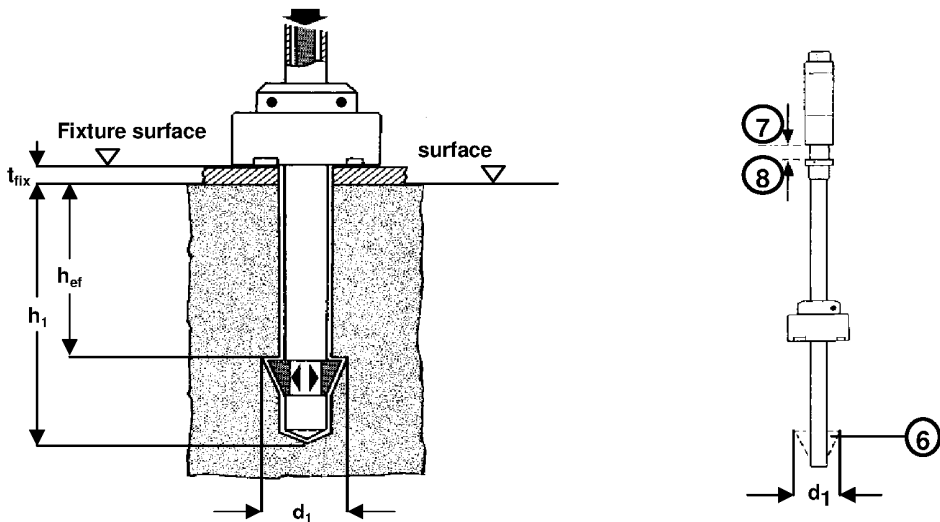
2. Undercut operation

The undercutting tool is pre-adjusted by the manufacturer to the effective embedment depth h_{ef} (measured from the concrete surface).

When drilling through the fixture, the effective embedment depth h_{ef} has to be re-adjusted by sliding the embedment depth gauge (5) on the handle with a distance corresponding to the fixture thickness t_{fix} in order to get the total drill depth S . This can be easily done by using the scale on the handle.



- Loosen the hexagon socket screws (4), slide the gauge (5) on the handle. The total drill depth S equates to the effective embedment depth h_{ef} plus the fixture thickness t_{fix} .
- Re-tighten the hexagon socket screws.
- The undercutting diameter d_1 has to be adjusted with the help of an adjusting gauge provided with the undercutting tool or with a sliding caliper vernier gauge and has to be checked regularly during the drilling operation (due to abrasion or wearing down of the diamond cutting elements).
- Insert undercutting tool into concrete hole until embedment depth gauge touches the concrete surface or the fixture.
- Turn on the water supply before beginning the undercut drilling process.



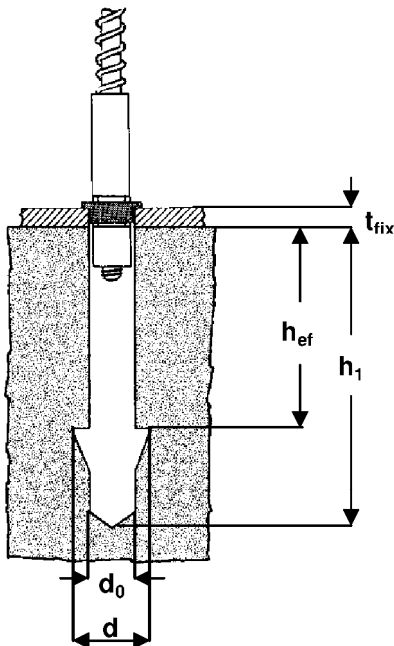
By pressing the upper part of the undercutting tool (7) telescopically down to the depth gauge (8) until they have contact, the segments (6) open automatically to the correctly adjusted diameter d_1 .

The drilling dust is washed out by the flowing water, which should be allowed to continue flowing for a few seconds to flush out the hole.

Do not move the undercut tool. Turn off the drilling machine with the undercut tool still at its deepest position within the hole, release the diamond cutting blades and finally remove the undercutting tool from the hole.

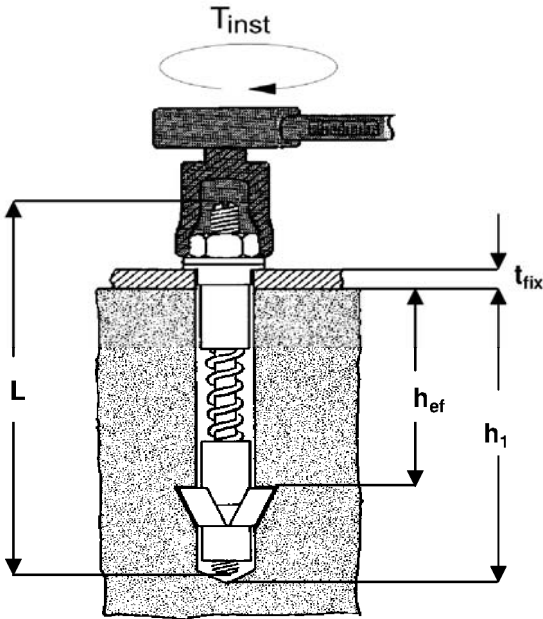
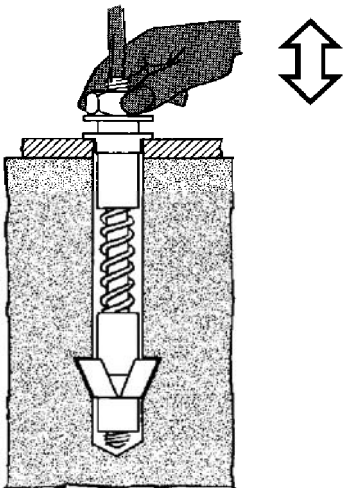
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3. Anchor setting



The Sormat Liebig Ultraplus™ A4 undercut anchor is inserted into the hole through the fixture. The plastic ring, that holds the clamping segments together, remains at the top of the hole in the fixture. The clamping segments open automatically when located in the undercut (this can be felt and heard).

Ensure that the clamping segments have located into the undercut by trying to move the anchor up and down.



Apply installation torque T_{inst} using a calibrated torque-wrench.

Type	Installation torque T_{inst} [Nm]
UP M10 - 19/110/..	45
UP M12 - 23/140/..	80
UP M16 - 30/220/..	250
UP M20 - 36/250/..	300

Sormat Liebig® Ultraplus™ A4 undercut anchor

Annex 11

Installation instructions