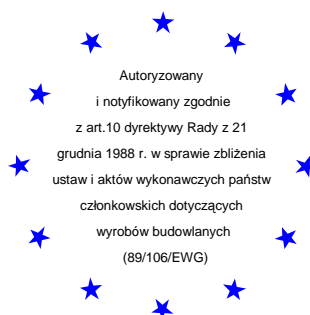


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Członek EOTA

European Technical Approval

ETA-09/0153

(English language translation – the original version is in Polish language)

Nazwa handlowa

Trade name

LIEBIG VESF

LIEBIG VESF

Właściciel aprobaty

Holder of approval

SIMPSON Strong – Tie Ireland Ltd.

ZNL - Deutschland

Wormser Strasse 23

D-64319 Pfungstadt, Germany

Rodzaj i przeznaczenie wyrobu

*Generic type and use
of construction products*

**Kotwy wklejane z prętami ze stali ocynkowanej o
średnicach M8, M10, M12, M16, M20 i M24 do
wykonywania zamocowań w betonie
niezarysowanym**

*Bonded anchor with anchor rod made of galvanised steel of
sizes M8, M10, M12, M16, M20 and M24 for use in non-
cracked concrete*

Termin ważności

Valid

od

from

08. 05. 2009

do

to

09. 11. 2011

Zakład produkcyjny

Manufacturing plant

Plant 4

Niniejsza Europejska

Aprobata Techniczna zawiera

*This European Technical
Approval contains*

16 stron, w tym 7 Załączników

16 pages including 7 Annexes



Europejska Organizacja ds. Aprobatach Technicznych

European Organisation for Technical Approvals

I LEGAL BASES AND GENERAL CONDITIONS

1. This European Technical Approval is issued by Instytut Techniki Budowlanej 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, amended by the Council Directive 93/68/EEC of 22 July 1993²;
 - ustawa z dnia 16 kwietnia 2004 r. o wyrobach budowlanych (law on construction products from 16th April 2004)³;
 - rozporządzenie Ministra Infrastruktury z dnia 14 października 2004 r. w sprawie europejskich aprobat technicznych oraz polskich jednostek organizacyjnych upoważnionych do ich wydawania (regulation of Ministry of Infrastructure of 14th October 2004 on the European Technical Approvals and Polish bodies entitled to issue them)⁴;
 - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC⁵;
 - Guideline for European Technical Approval of “*Metal anchors for use in concrete – Part 5: Bonded anchors*”, ETAG 001-05;
 - Instytut Techniki Budowlanej 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.
2. 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.
3. This European Technical Approval may be withdrawn by Instytut Techniki Budowlanej, in particular after information by the Commission on the basis of Article 5 (1) of Council Directive 89/106/EEC.
4. 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 Instytut Techniki Budowlanej. 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.
5. 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.

¹ Official Journal of the European Communities № L 40, 11.02.1989, p. 12

² Official Journal of the European Communities № L 220, 30.08.1993, p. 1

³ Official Journal of Polish Republic № 92/2004, pos. 881

⁴ Official Journal of Polish Republic № 237/2004, pos. 2375

⁵ Official Journal of the European Communities № L 17, 20.01.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of product

The LIEBIG VESF in the sizes of M8 to M24 are the bonded anchors (injection type) made of carbon steel (galvanised), threaded rod, which is placed into a drilled hole previously injected with a two components injection mortar using an applicator gun equipped with a special mixing nozzle. The threaded rod is inserted into the resin with a slow and slight twisting motion. The threaded rod is available for all diameters with three type of tip end: a one side 45° chamfer, a two sides 45° chamfer or a flat. The threaded rods are either delivered with the mortar cartridges or commercial standard threaded rods purchased separately. The mortar cartridges are available in different sizes (150 ml to 825 ml) and types (coaxial, side by side or two-layers cartridges "chubpack 10:1" with plastic insert). The anchors are intended to be used with embedment depth given in Annex 4, Table 6.

For the installed anchor see Figure given in Annex 1.

1.2 Intended use

The anchors are 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. Safety in case of fire (Essential Requirement 2) is not covered by this ETA. The anchors are to be used only for anchorages subject to static or quasi-static loading in reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum to C50/60 at maximum according to EN 206-1. The anchors may be anchored in non-cracked concrete only.

The anchors may be used in structures subject to dry internal conditions only.

The anchors may be installed in dry or wet concrete (use category 1) or in flooded holes excepting sea water (use category 2) for all diameters.

All the diameters (i.e. from M8 to M24) may be used overhead.

The anchors may be used in the following temperature range: -40°C to +40°C (max short term temperature +40°C and max long term temperature +24°C).

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 or Approval Body, 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 anchors in the sizes of M8 to M24 and the mortar cartridges correspond to the drawings and provisions given in Annexes 1 and 2. The characteristic material values, dimensions and tolerances of the anchors not indicated in Annexes 3 and 4 shall correspond to the respective values laid down in the technical documentation⁶ of this European Technical Approval. The characteristic anchor values for the design of anchorages are given in Annexes 5 to 7.

Each mortar cartridge is marked with the identifying mark of the producer and with the trade name. The threaded rod are either delivered with the mortar cartridges or commercial standard threaded rods purchased separately.

The two components of the LIEBIG VESF injection mortar could be delivered in unmixed condition in mortar cartridges in a size of 150 ml, 380 ml, 400 ml and 410 ml in case of coaxial cartridges, 235 ml, 345 ml and 825 ml in case of side by side cartridges and 150 ml, 165 ml, 170 ml, 280 ml and 300 ml in case of "chubpack 10:1" cartridges according to Annex 2.

2.2 Methods of verification

The assessment of fitness of the anchors 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 ETAG 001 Guideline for European Technical Approval of "Metal anchors for use in concrete", Part 1: "Anchors in general" and Part 5: "Bonded anchors", on the basis of Option 7.

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 UE 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 of 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 of the approved body:

⁶ The technical documentation of this European Technical Approval is deposited at Instytut Techniki Budowlanej and, as far as relevant for the tasks of the approved body involved in the attestation of conformity procedure, may be handed over only to the approved body involved.

- 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; factory production control

The manufacturer has a factory production control system in the plant and exercises 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 control plan⁷. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of incoming materials such as nuts, washers, threaded rods, resin, hardeners shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying dimensions and determining material properties.

The manufactured components of the anchors shall be subjected to the following tests:

- dimensions of components: threaded rod (total length, nominal diameter, marking), washer (diameter, thickness), resin (fill quantity, fill weight), hardener (fill quantity, fill weight) nut (diameter, good functioning),
- material properties: threaded rod (yielding and ultimate tensile strength), nut (proof load), resin (composition, viscosity), hardener (composition, viscosity),
- visual control of completeness of the anchor,
- visual control of the aspect of cartridges.

The frequency of controls and tests conducted during production is laid down in the control plan⁷ taking account of the automated manufacturing process of the anchors.

The results of factory production control are recorded and evaluated. The records include at least the following information:

- designation of the product, basic material and components,
- type of control or testing,
- date of manufacture of the product and date of testing of the product or basic material or components,
- result of control and testing and, if appropriate, comparison with requirements,
- signature of person responsible for factory production control.

The records shall be presented to the approved body involved in continuous surveillance. On request, they shall be presented to Instytut Techniki Budowlanej.

Details of the extent, nature and frequency of testing and controls to be performed within the factory production control shall correspond to the control plan⁷ which is part of the technical documentation of this European Technical Approval.

⁷ The control plan has been deposited at Instytut Techniki Budowlanej and may be handed over only to the approved body involved in the conformity attestation procedure.

3.2.2 Tasks of the approved body

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 Instytut Techniki Budowlanej and the approved body involved.

3.2.2.2 Initial inspection of factory and of factory production control

The approved body shall ascertain that, in accordance with the control plan⁷, the factory, in particular the staff and equipment, and the factory production control are suitable to ensure continuous and orderly manufacturing of the anchor according to the specifications mentioned in clause 2.1 as well as to the Annexes to this European Technical Approval.

3.2.2.3 Continuous surveillance

Continuous surveillance and assessment of factory production control have to be performed according to the control plan⁷.

The approved body shall visit the factory at least once a year for surveillance. It has to be verified that the system of factory production control and the specified automated manufacturing process are maintained taking account of the control plan⁷.

The results of continuous surveillance shall be made available on demand by the approved body to Instytut Techniki Budowlanej. In cases where the provisions of the European Technical Approval and the control plan⁷ are no longer fulfilled the conformity certificate shall be withdrawn.

3.3 CE-Marking

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

- identification number of the approved body,
- name or identifying mark of the manufacturer and manufacturing plant,
- the last two digits of the year in which the CE-marking was affixed,
- number of the EC certificate of conformity,
- number of the European Technical Approval,
- use category (ETAG 001-01, Option 7),
- size.

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

4.1 Manufacturing

The anchors are manufactured in accordance with the provisions of the European Technical Approval using the automated manufacturing process as identified during

⁷ see page 5

inspection of the plant by Instytut Techniki Budowlanej and laid down in the technical documentation.

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 ETAG 001 “*Metal anchors for use in concrete*”, Annex C, Method A, for bonded anchors under the responsibility of an engineer experienced in anchorages and concrete work.
- For the verifications given below according to Annex C the following shall be observed :
 - For the verification "concrete cone failure" (clause 5.2.2.4, Annex C of the ETAG, $N_{Rk,c}$ shall be determined according to (1) and (2); the smaller of the values according to (1) and (2) is decisive.
 - (1) $N_{Rk,c}$ according to equation (5.2), Annex C of the ETAG
 where: $N_{Rk,c}^0$ according to Table 8, Annex 5
 $s_{cr,n}$ and $c_{cr,n}$ according to Table 8, Annex 5
 $\Psi_{ucr,N} = 1,0$
 - (2) $N_{Rk,c}$ according to equation (5.2), Annex C of the ETAG
 where: $N_{Rk,c}^0 = 0,75 \times 15,5 \times h_{ef}^{1,5} \times f_{ck,cube}^{0,5}$
 $s_{cr,n} = 3 h_{ef}$ and $c_{cr,n} = 1,5 h_{ef}$
 $\Psi_{ucr,N} = 1,0$
 - For the verification "splitting failure due to loading" (clause 5.2.2.6, Annex C of the ETAG), $N_{Rk,sp}$ shall be determined according to (3).
 - (3) $N_{Rk,sp}$ according to equation (5.3), Annex C of the ETAG
 where: $N_{Rk,c}^0$ according to Table 8, Annex 5,
 $s_{cr,sp}$ and $c_{cr,sp}$ according to Table 8, Annex 5,
 $\Psi_{ucr,N} = 1,0$ and $\Psi_{h,sp} = 1,0$.
- For the verification "concrete pryout failure" (clause 5.2.3.3, Annex C of the ETAG), $N_{Rk,c}$ for equation (5.6), Annex C of the ETAG shall be determined according to (1).
- 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.).

4.2.2 Installation of the anchors

The fitness for use of the anchors can only be assumed if the anchors are installed as follows:

- anchors 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,
- use of the anchor with commercial standard rods, washers and hexagonal nuts under the following requirements:
 - material and mechanical properties according to the specifications given in Annex 3, Table 1,
 - confirmation of material and mechanical properties by inspection certificate according to EN-10204:2004; the documents should be stored,
 - marking of the threaded rod with the envisaged embedment depth; this may be done by the manufacturer of the rod or the person on job site,
- anchors installation in accordance with the manufacturer's specifications and drawings using the tools indicated in the technical documentation of this European Technical Approval,
- 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,
- check of concrete being well compacted, e.g. without significant voids,
- keeping the effective anchorage depth,
- 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 drill hole: the drill hole shall be filled with mortar,
- clearing the hole of drilling dust: the hole shall be cleaned by at least five blowing operations, by at least four brushing operations followed again by at least five blowing operations (four blow + one blow for final control), before brushing cleaning the brush and checking whether the brush diameter according to Annex 3, Table 3 is sufficient,
- 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,
- mortar injection by using the equipment including the special mixing nozzle shown in Annex 2; discarding the first swings of mortar of each new cartridge until an homogeneous colour is achieved; taking from the manufacturer instruction the admissible processing time (open time) of a cartridge as a function of the ambient temperature of the concrete; filling the drill hole uniformly from the drill hole bottom, in order to avoid entrapment of air; removing the special mixing nozzle slowly bit by bit during pressing-out; filling the drill hole with a quantity of the injection mortar corresponding to 1/2 of the drill hole; inserting immediately the threaded rod, slowly and with a slight twisting motion, removing excess of injection mortar around the rod; observing the loading (curing) time according to Annex 3, Table 4 until the rod may be loaded; during curing of the injection mortar the temperature of the concrete must not fall below -5°C,
- application of the torque moment given in Annex 4, Table 6 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 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,
- required torque moment,
- admissible service temperature range,
- loading (curing) time of the bonding material depending on the installation temperature,
- 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.

5 Recommendations on packaging, transport and storage

The mortar cartridges shall be protected against sun radiation and shall be stored according to the manufacturer's instructions in dry conditions at temperatures of at least 0°C to not more than +35°C.

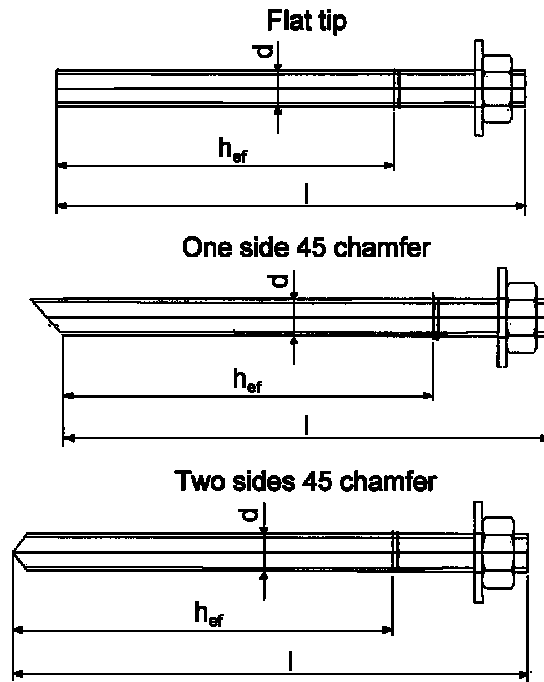
Mortar cartridges with expired shelf life must no longer be used.

On behalf of Instytut Techniki Budowlanej

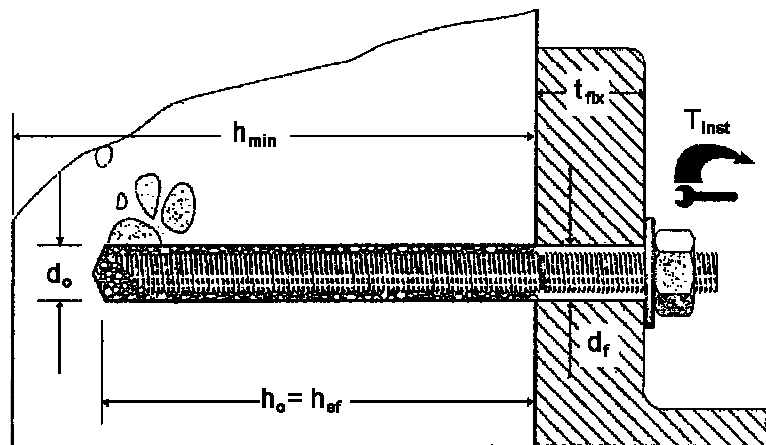


Marek Kaproń
Director of ITB

Assembled anchor and schema of the anchor use:



schema of the anchor in use

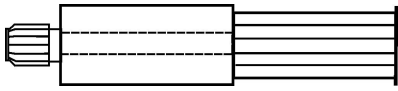

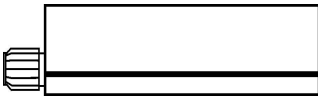


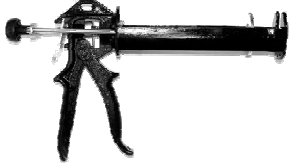
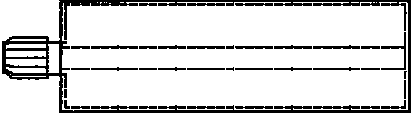



LIEBIG VESF

Product and intended use

Annex 1
of European
Technical Approval
ETA-09/0153

Mortar cartridges and applicator guns:

	Cartridge	Applicator gun
coaxial cartridge: 150 ml		
side-by-side cartridge: 235 ml 345 ml 825 ml		
coaxial cartridge: 380 ml 400 ml 410 ml		
two-layers cartridge "chubpack 10:1" with plastic insert 150 ml 165 ml 170 ml 280 ml 300 ml		

Special mixing nozzle:



LIEBIG VESF	Annex 2 of European Technical Approval ETA-09/0153
Mortar cartridges	

Table 1: Materials

	Size	Material and EN/ISO reference
Injection mortar with styrenefree vinylester resin, hardener and inorganic agents		
Threaded rod	M8 to M24	Galvanised carbon steel grade 5.8 to 10.9 EN ISO 898-1
Nut	–	Material of the corresponding anchor rod
Washer	–	Material of the corresponding anchor rod

Table 2: Cleaning method

Nominal diameter	All diameters
Cleaning method	5 x blow followed by 4 x brush followed by 4 x blow + 1 x blow for final control

Table 3: Brush diameter

Anchor size	M8	M10	M12	M16	M20	M24
Brush diameter [mm]	14	14	20	20	29	29

Table 4: Application data

Temperature [°C]	Processing time [minutes]	Minimum loading time (curing time) [minutes]
-5 to 0	25	150
1 to 5	12	80
6 to 10	9	50
11 to 15	6	45
16 to 20	5	35
21 to 25	3	30

Brush for cleaning the drill hole



LIEBIG VESF	Annex 3 of European Technical Approval ETA-09/0153
Materials and cleaning method	

Table 5: Dimensions

Size	M8	M10	M12	M16	M20	M24
d	8	10	12	16	20	24
l	110	130	150	170	230	260
h_{ef}	80	90	100	130	170	210

Table 6: Installation data

Size	Drilling diameter d_0 [mm]	Torque moment T_{inst} [Nm]	Depth of the drilling hole h_0 [mm]	Embedment depth h_{ef} [mm]	Minimum thickness of the slab h_{min} [mm]
M8	10	15	80	80	160
M10	12	30	90	90	180
M12	14	50	100	100	200
M16	18	100	130	130	260
M20	22	160	170	170	340
M24	28	240	210	210	420

Table 7: Minimum thickness, spacing and edge distance

Size		M8	M10	M12	M16	M20	M24
Minimum thickness	h_{min} [mm]	160	180	200	260	340	420
Minimum spacing	s_{min} [mm]	40	45	50	75	85	105
Minimum edge distance	c_{min} [mm]	40	45	50	75	85	105

LIEBIG VESF

Installation data

Annex 4
of European
Technical Approval
ETA-09/0153

Table 8: Characteristic values of resistance to tension loads of design method A

Size		M8	M10	M12	M16	M20	M24
Steel failure							
Steel failure with standard threaded rod grade 5.8							
Characteristic resistance	$N_{Rk,s}$ [kN]	19	30	44	82	127	184
Partial safety factor	γ_{Ms}	1,5					
Steel failure with standard threaded rod grade 6.8							
Characteristic resistance	$N_{Rk,s}$ [kN]	22	35	51	94	147	212
Partial safety factor	γ_{Ms}	1,5					
Steel failure with standard threaded rod grade 8.8							
Characteristic resistance	$N_{Rk,s}$ [kN]	29	46	67	126	196	282
Partial safety factor	γ_{Ms}	1,5					
Steel failure with standard threaded rod grade 10.9							
Characteristic resistance	$N_{Rk,s}$ [kN]	38	60	88	163	255	367
Partial safety factor	γ_{Ms}	1,4					
Pullout and concrete cone failure							
Characteristic resistance In non-cracked concrete C20/25	$N_{Rk,p}$ [kN] $N_{Rk,c}$ [kN]	16	25	40	75	95	140
Increasing factor C30/37	Ψ_c	1,08					
Increasing factor C40/50	Ψ_c	1,15					
Increasing factor C50/60	Ψ_c	1,18					
Partial safety factors for in use category 1	γ_{Mp}	2,16				2,52	
Partial safety factors for in use category 2	γ_{Mc}	2,16				2,52	
Splitting failure							
Effective anchorage depth	[mm]	80	90	100	130	170	210
Partial safety factors for in use category 1	γ_{Msp}	2,16				2,52	
Partial safety factors for in use category 2	γ_{Msp}	2,16				2,52	
Spacing	$s_{cr,N}$ [mm]	160	180	200	260	340	420
	$s_{cr,sp}$ [mm]	240	270	300	390	510	630
Edge distance	$c_{cr,N}$ [mm]	80	90	100	130	170	210
	$c_{cr,sp}$ [mm]	120	135	150	195	255	315

LIEBIG VESF

Characteristic resistance under tension loads – design method A

Annex 5
of European
Technical Approval
ETA-09/0153

Table 9: Characteristic values of resistance to shear loads of design method A

Size	M8	M10	M12	M16	M20	M24
Steel failure without lever arm						
Steel failure with standard threaded rod grade 5.8						
Characteristic resistance $V_{Rk,s}$ [kN]	9	15	22	41	64	92
Partial safety factor γ_{Ms}	1,25					
Steel failure with standard threaded rod grade 6.8						
Characteristic resistance $V_{Rk,s}$ [kN]	11	17	25	47	73	106
Partial safety factor γ_{Ms}	1,25					
Steel failure with standard threaded rod grade 8.8						
Characteristic resistance $V_{Rk,s}$ [kN]	15	23	34	63	98	141
Partial safety factor γ_{Ms}	1,25					
Steel failure with standard threaded rod grade 10.9						
Characteristic resistance $V_{Rk,s}$ [kN]	19	30	44	82	127	184
Partial safety factor γ_{Ms}	1,50					
Steel failure with lever arm						
Steel failure with standard threaded rod grade 5.8						
Characteristic resistance $M_{Rk,s}$ [kN]	19	39	68	173	337	584
Partial safety factor γ_{Ms}	1,25					
Steel failure with standard threaded rod grade 6.8						
Characteristic resistance $M_{Rk,s}$ [kN]	22	45	79	200	389	673
Partial safety factor γ_{Msp}	1,25					
Steel failure with standard threaded rod grade 8.8						
Characteristic resistance $M_{Rk,s}$ [kN]	30	60	105	266	519	898
Partial safety factor γ_{Ms}	1,25					
Steel failure with standard threaded rod grade 10.9						
Characteristic resistance $M_{Rk,s}$ [kN]	39	78	136	346	675	1167
Partial safety factor γ_{Ms}	1,50					
Pry out failure						
Factor k	2					
Partial safety factor γ_{Mp}	1,80					
Concrete edge failure						
Effective length of anchor under shear loading l_f [mm]	80	90	100	130	170	210
Diameter of anchor d_{nom} [mm]	8	10	12	16	20	24
Partial safety factor γ_{Mp}	1,80					

LIEBIG VESF

Characteristic resistance under shear loads – design method A

Annex 6
of European
Technical Approval
ETA-09/0153

Table 10: Characteristic displacement under tension loads

Size		M8	M10	M12	M16	M20	M24
Characteristic displacement in non-cracked C20/25 to C/50/60 concrete under tension loads							
Admissible service load	F [kN]	6	9	15	25	28	42
Displacement	δ_{N0}	0,3	0,3	0,3	0,3	0,4	0,4
	$\delta_{N\infty}$	0,7	0,7	0,7	0,7	0,7	0,7

Table 11: Characteristic displacement under shear loads

Size		M8	M10	M12	M16	M20	M24
Characteristic displacement in non-cracked C20/25 to C/50/60 concrete under shear loads							
Admissible service load	F [kN]	10	13	24	33	49	61
Displacement	δ_{V0}	2,5	2,5	2,5	2,5	2,5	2,5
	$\delta_{V\infty}$	3,8	3,8	3,8	3,8	3,8	3,8

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Characteristic displacements under tension and shear loads

Annex 7
of European
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