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

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European Technical Assessment ETA 18/1064 of 11/10/2022

English translation prepared by IETcc. Original version in Spanish language

General Part

Technical Assessment Body issuing the ETA designated according to Art. 29 of Regulation (EU) 305/2011	Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)
Trade name of the construction product	**ESSVE EUS concrete screw**
Product family to which the construction product belongs	Concrete screw of sizes 7.5, 10.5, 12.5, 14.2 and 16.5 for use in cracked and non-cracked concrete.
Manufacturer	**ESSVE Produkter AB.** Esbogatan 14, 164 74 Kista, Sweden. website: www.essve.com
Manufacturing plants	**Plant no. 421**
This European Technical Assessment contains	22 pages including 4 annexes which form an integral part of this assessment.
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	European Technical Assessment EAD 330232-01-0601 “Mechanical Fasteners for use in concrete”, ed. December 2019
This ETA replaces	ETA 18/1064 version 1 issued on 28/01/2019

English translation prepared by IETcc

This European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission according to article 25 (3) of Regulation (EU) No 305/2011.

English translation prepared by IETcc

SPECIFIC PART

1. Technical description of the product

The ESSVE EUS concrete screw is an anchor made of carbon steel. The anchor is made in sizes 7.5, 10.5. 12.5, 14.2 and 16.5, and is screwed into a predrilled cylindrical drill hole. The special thread of the anchor cuts an internal thread into the member while setting. The anchorage is characterised by mechanical interlock in the special thread.

The product and its installation description are shown in annexes A.

2. Specification of the intended use in accordance with the applicable European Assessment Document.

The performances given in section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means to choosing the right products in relation to the expected economically reasonable working life of the works.

3. Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Static or quasi static actions	See annexes C1 to C5
Essential characteristic and displacements for seismic performance categories C1 and C2	See annexes C6 and C7

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for class A1
Resistance to fire	See annex D

4. Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

The applicable European legal act for the system of Assessment and Verification of Constancy of Performances (see annex V of Regulation (EU) No 305/2011) is 96/582/EC.

The system to be applied is 1.

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document.

The technical details necessary for the implementation of the AVCP system are laid down in the quality plan deposited at Instituto de Ciencias de la Construcción Eduardo Torroja.

Instituto de Ciencias de la Construcción Eduardo Torroja
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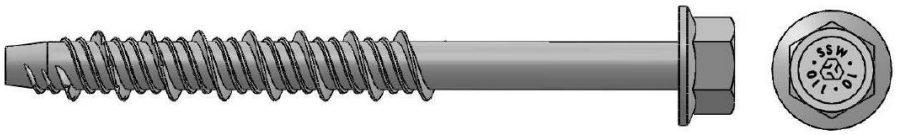
On behalf of the Instituto de Ciencias de la Construcción Eduardo Torroja
Madrid, 11th of October 2022

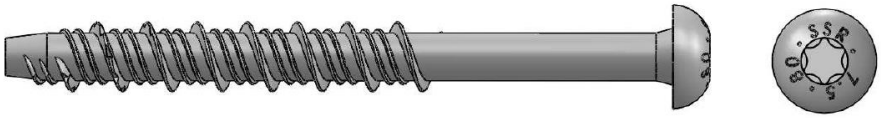
Firmado por CASTILLO TALAVERA ANGEL - DNI 52507605P
Fecha: 26/10/2022 07:27:05 CEST

Director IETcc-CSIC

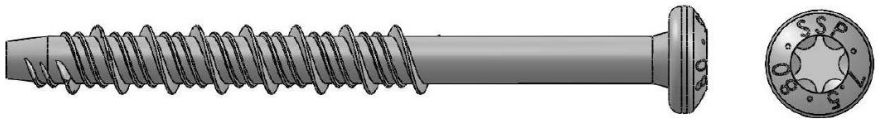
Product and identification



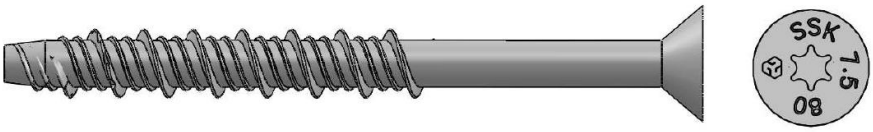
EUS - SSW



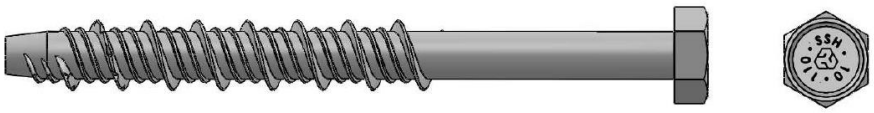
EUS - SSR



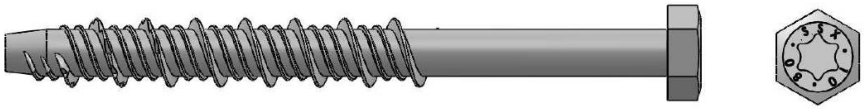
EUS - SSP



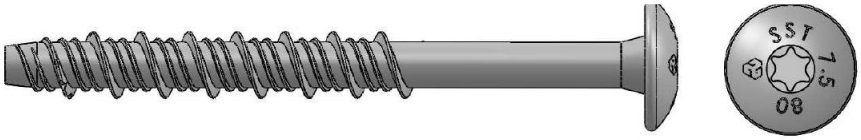
EUS - SSK



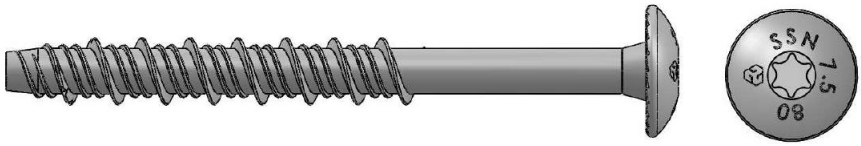
EUS - SSH



EUS - SSX



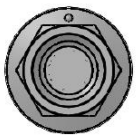
EUS - SST



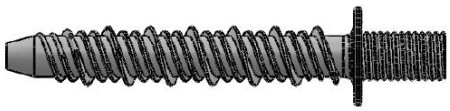
EUS - SSN

ESSVE EUS concrete screw	**Annex A1**
Product description Identification	

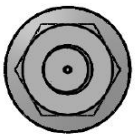
EUS - SSD

EUS - SSI

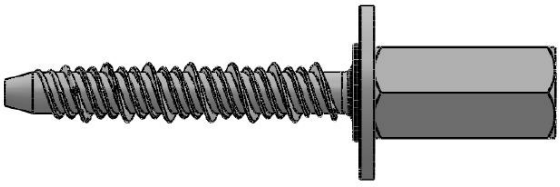
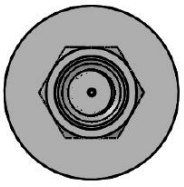



EUS - SSF

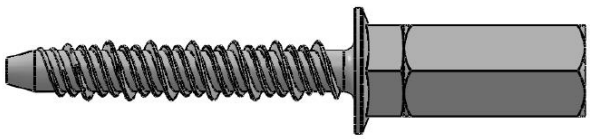
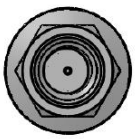



EUS - SSO

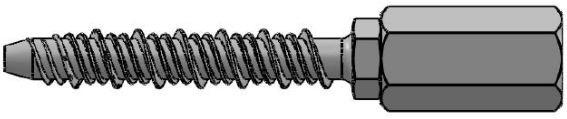

EUS - SSU

EUS - SSG

EUS - SSQ




EUS - SSV

ESSVE EUS concrete screw	
Product description Identification	**Annex A2**

EUS – SSG2

EUS - SSC

Marking/Identification on anchor:

- Company logo
- Outer diameter
- Length
- Anchor type:

Hex head with washer	EUS - SSW
Round head	EUS - SSR
Pan head	EUS - SSP
Countersunk head	EUS - SSK
Hex head	EUS - SSH
Hex head, hexalobular recess	EUS - SSX
Truss head	EUS - SST
Truss head with underhead ribs	EUS - SSN
Connection thread with hexagon drive	EUS - SSD
Internal thread	EUS - SSI
Flat washer head with connection thread	EUS - SSF
Hex washer head with connection thread	EUS - SSO
Hex head with connection thread	EUS - SSU
SSF flex with coupler nut	EUS - SSG
SSO flex with coupler nut	EUS - SSQ
SSU flex with coupler nut	EUS - SSV
SSG flex without washer	EUS - SSG2
Hexagon head with bevelled shoulder	EUS - SSC

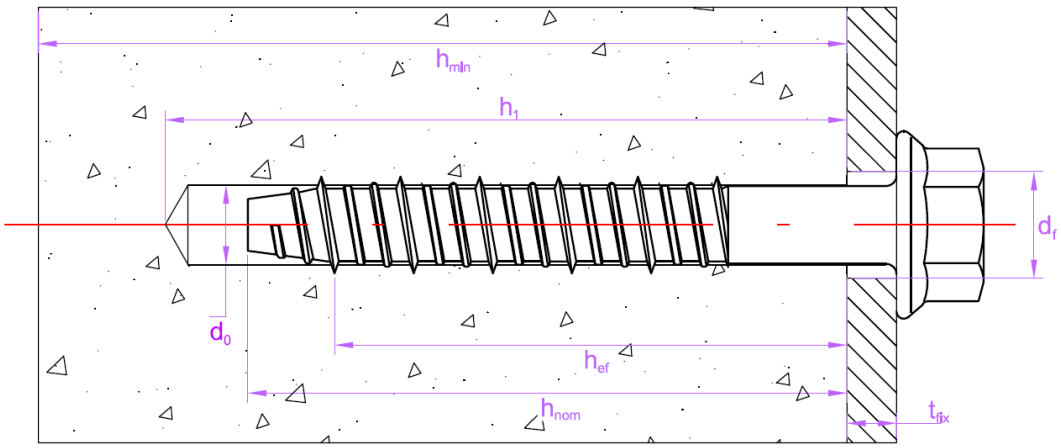
ESSVE EUS concrete screw	
Product description Identification	**Annex A3**

Table A1: Materials

Item	Designation	ESSVE EUS concrete screw
1	Anchor Body	Carbon steel wire rod cold forged. Allowed coatings: • Zinc plated ISO 4042 • Silver ruspert • Zinc flake EN 10683 • Mechanical plated.

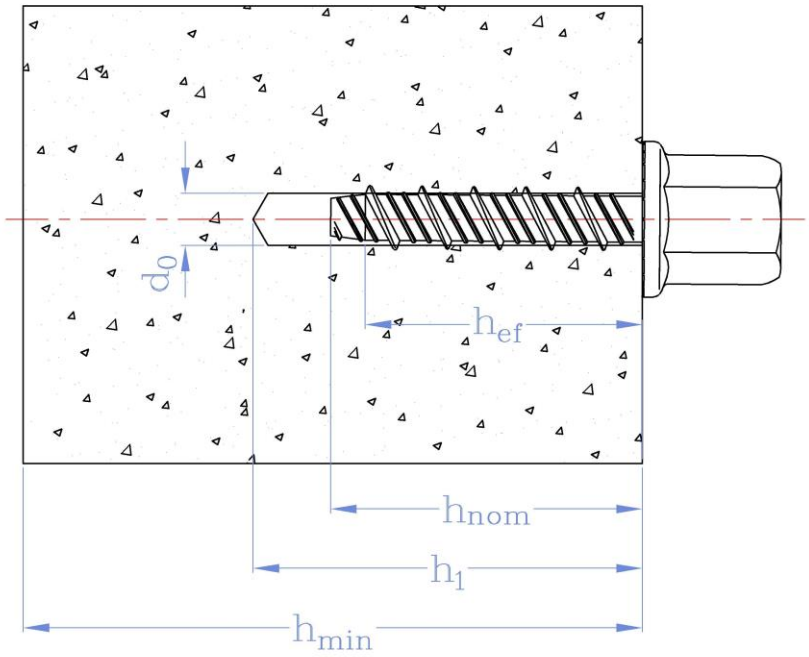
Installed condition

h_{ef}: Effective anchorage depth
h_1: Depth of drilled hole
h_{nom}: Overall anchor embedment depth in the concrete
h_{min}: Minimum thickness of concrete member
t_{fix}: Thickness of fixture
d_0: Nominal diameter of drill bit
d_f: Diameter of clearance hole in fixture

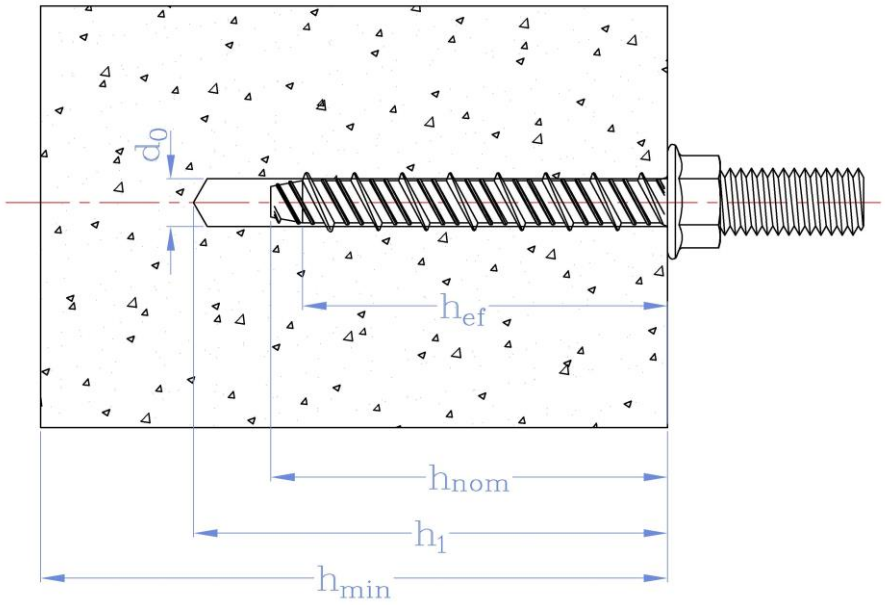


Drawing A1. Installed condition for anchors EUS - SSW, EUS - SSR, EUS - SSP, EUS - SSK, EUS - SSH, EUS - SSX, EUS - SST, EUS - SSN and EUS - SSC.

ESSVE EUS concrete screw	
Product description Installed condition	**Annex A5**



Drawing A2. Installed condition for anchors EUS - SSD, EUS - SSI, EUS - SSF, EUS - SSO, EUS - SSU, EUS - SSG, EUS - SSQ, EUS – SSV and EUS - SSG2.



Drawing A3. Installed condition for anchors EUS - SSD, EUS - SSI, EUS - SSF, EUS - SSO, EUS - SSU, EUS - SSG, EUS - SSQ, EUS - SSV and EUS - SSG2.

ESSVE EUS concrete screw	**Annex A6**
Product description Installed condition	

Intended use

Anchorages subjected to:

- Static or quasi static loads: all sizes and embedment depths.
- Seismic actions for performances C1 and C2 as per table bellow

Size	**7.5**		**10.5**		**12.5**			**14.2**		**16.5**	
h_{nom}	40	55	50	60	60	70	85	75	105	75	110
C1				✓			✓				✓
C2							✓				✓

Base materials:

- Reinforced and unreinforced normal weight concrete without fibers according to EN 206:2013 + A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016.
- Cracked and uncracked concrete.

Use conditions (environmental conditions):

- The anchor shall be used in dry internal conditions.
- The anchor may be used for anchorages with requirements related to resistance to fire.

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete.
- Verifiable calculation rules and drawings are prepared taking into account of the loads to be attached. The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.)
- Anchorages under static or quasi-static loads are designed for design Method A in accordance with EN 1992-4:2018
- Anchorages under seismic actions are designed in accordance with EN 1992-4:2018. Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure. Fastening in stand-off installation or with grout layer are not allowed.
- Anchorages under fire exposure are designed in accordance with EN 1992-4:2018. It must be ensured that local spalling of the concrete cover does not occur.
- Shear assessment only covers the shear force induced by the fixed piece, i.e. the piece located between the anchor head and the concrete block (piece contained in t_{fix}, see Drawing A1).

Installation:

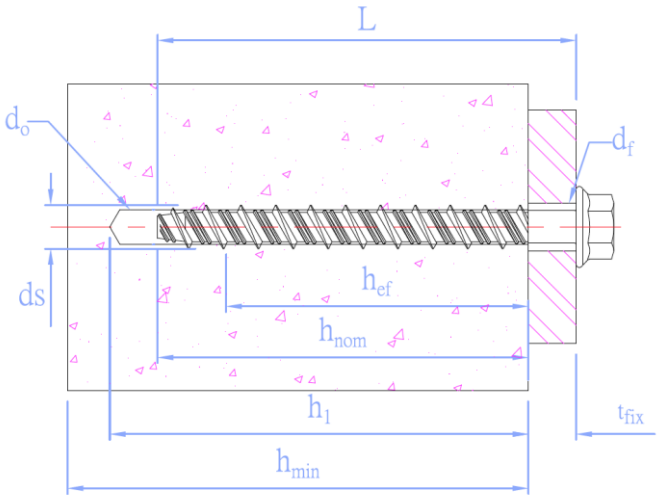
- Hammer drilling only.
- Anchor installation carried out by appropriately qualified personal and under the supervision of the person responsible for technical matters of the site.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of aborted hole or smaller distance if the aborted hole is filled with high strength mortar and if under shear or oblique tension load it is not the direction of the load application.
- After installation further turning of the anchor is not possible. The head of the anchor is supported on the fixture, as it is shown in Drawing A1, and it must not be damaged.

ESSVE EUS concrete screw	
Intended use Specifications	**Annex B1**

Table B1: Installation parameters

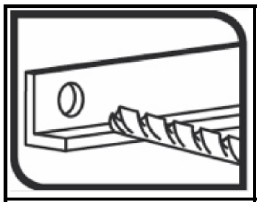
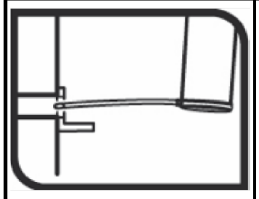
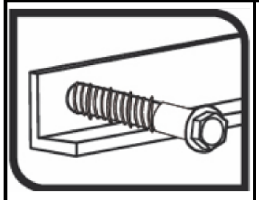
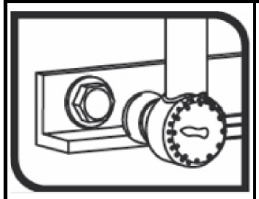
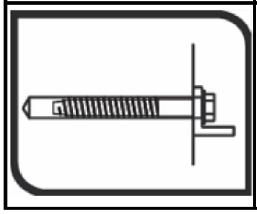
Installation parameters			Performance						
			EUS 7.5		EUS 10.5		EUS 12.5		
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	40	55	50	60	60	70	85
d_0	Nominal diameter of drill bit:	[mm]	6		8		10		
d_f	Diameter of clearance hole in fixture:	[mm]	9		12		14		
d_s	Outer diameter of the thread	[mm]	7.5		10.5		12.5		
h_{min}	Minimum thickness of concrete member:	[mm]	100	100	100	100	100	105	130
h_1	Depth of drilled hole:	[mm]	50	65	60	70	70	85	100
h_{ef}	Effective anchorage depth:	[mm]	29	42	37	45	44	52	65
T_{ins}	Installation torque	[Nm]	15		25		50		
t_{fix}	Thickness of fixture	[mm]	L-40	L-55	L-50	L-60	L-60	L-70	L-85
s_{min}	Minimum allowable spacing:	[mm]	35	45	35	50	50	60	70
c_{min}	Minimum allowable edge distance:	[mm]	35	45	35	50	40	60	60

Installation parameters			Performance			
			EUS 14.2		EUS 16.5	
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	75	105	75	110
d_0	Nominal diameter of drill bit:	[mm]	12		14	
d_f	Diameter of clearance hole in fixture:	[mm]	16		18	
d_s	Outer diameter of the thread	[mm]	14.2		16.5	
h_{min}	Minimum thickness of concrete member:	[mm]	120	170	120	175
h_1	Depth of drilled hole:	[mm]	90	120	90	130
h_{ef}	Effective anchorage depth:	[mm]	57	82	56	86
T_{ins}	Installation torque	[Nm]	60		80	
t_{fix}	Thickness of fixture	[mm]	L-75	L-105	L-75	L-110
s_{min}	Minimum allowable spacing:	[mm]	70	70	75	100
c_{min}	Minimum allowable edge distance:	[mm]	45	45	45	100



Drawing B1. Installed condition for anchors EUS - SSW, EUS - SSR, EUS - SSP, EUS - SSK, EUS - SSH, EUS - SSX, EUS - SST, EUS - SSN and EUS - SSC.

Installation process

	1. DRILL Drill a hole into the base material of correct diameter and depth by using a carbide drill bit in rotary plus hammer mode.
	2. BLOW and CLEAN Remove dust and debris from hole and loose particles left from drilling by using hand pump, compressed air or vacuum.
	3. INSTALL Hold screw anchor perpendicular direction into the base material through fixtures.
	4. APPLE TORQUE Select a power impact wrench or a torque wrench(e.g: Bosch GDS 18E, power input: 500 W; torque: 50-250 Nm). Power impact wrench does not exceed over torque Tinst.
	5. CHECK The head must be undamaged and in contact with the fixture. When screw head attach fixture or concrete surface firmly, furthre turning of the head is unnecessary.

ESSVE EUS concrete screw	
Performances Installation parameters and installation procedure	**Annex B3**

Table C1: Characteristic values to tension loads of design method A

Characteristic values of resistance to tension loads of design method A			Performance						
			EUS 7.5		EUS 10.5		EUS 12.5		
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	40	55	50	60	60	70	85
Tension loads: steel failure									
$N_{Rk,s}$	Tension steel characteristic resistance:	[kN]	18.7		32.7		51.2		
γ_{Ms}	Partial safety factor: [1)]	[-]	1.5		1.5		1.5		
Tension loads: pull-out failure in concrete									
$N_{Rk,p,ucr}$	Tension characteristic resistance in C20/25 uncracked concrete:	[kN]	6.0	9.0	[2)]	12.0	[2)]	20	[2)]
$\psi_{c,ucr}$	C30/37	[-]	1.16	1.22	1.16	1.08	1.15	1.04	1.09
$\psi_{c,ucr}$	C40/45	[-]	1.28	1.41	1.28	1.15	1.27	1.07	1.15
$\psi_{c,ucr}$	C50/60	[-]	1.39	1.55	1.39	1.19	1.37	1.09	1.21
$N_{Rk,p,cr}$	Tension characteristic resistance in C20/25 cracked concrete:	[kN]	3.0	6.0	6.5	9.0	[2)]	12	[2)]
$\psi_{c,cr}$	C30/37	[-]	1.17	1.22	1.16	1.22	1.14	1.22	1.18
$\psi_{c,cr}$	C40/45	[-]	1.30	1.41	1.29	1.41	1.25	1.41	1.33
$\psi_{c,cr}$	C50/60	[-]	1.42	1.55	1.40	1.55	1.34	1.55	1.46
Tension loads: concrete cone and splitting failure									
γ_{ins}	Installation safety factor: [1)]	[-]	1.2	1.2	1.2	1.2	1.2	1.2	1.0
h_{ef}	Effective embedment depth:	[mm]	29	42	37	45	44	52	65
$k_{ucr,N}$	Factor for uncracked concrete:	[-]	11.0						
$k_{cr,N}$	Factor for cracked concrete:	[-]	7.7						
$s_{cr,N}$	Critical spacing:	[mm]	$3.0 \times h_{ef}$						
$c_{cr,N}$	Critical edge distance:	[mm]	$1.5 \times h_{ef}$						
$s_{cr,sp}$	Critical spacing (splitting):	[mm]	$3.0 \times h_{ef}$						
$c_{cr,sp}$	Critical edge distance (splitting):	[mm]	$1.5 \times h_{ef}$						

[1)] In absence of other national regulations
[2)] Pull-out failure is not decisive

Characteristic values of resistance to tension loads of design method A			Performance			
			EUS 14.2		EUS 16.5	
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	75	105	75	110
Tension loads: steel failure						
$N_{Rk,s}$	Tension steel characteristic resistance:	[kN]	80.6		115.9	
γ_{Ms}	Partial safety factor: [1)]	[-]	1.5		1.5	
Tension loads: pull-out failure in concrete						
$N_{Rk,p,ucr}$	Tension characteristic resistance in C20/25 uncracked concrete:	[kN]	[2)]	[2)]	[2)]	40
$\psi_{c,ucr}$	C30/37	[-]	1.10	1.09	1.13	1.04
$\psi_{c,ucr}$	C40/45	[-]	1.17	1.16	1.24	1.07
$\psi_{c,ucr}$	C50/60	[-]	1.23	1.21	1.33	1.09
$N_{Rk,p,cr}$	Tension characteristic resistance in C20/25 cracked concrete:	[kN]	[2)]	[2)]	[2)]	30
$\psi_{c,cr}$	C30/37	[-]	1.11	1.08	1.14	1.12
$\psi_{c,cr}$	C40/45	[-]	1.19	1.15	1.26	1.23
$\psi_{c,cr}$	C50/60	[-]	1.26	1.20	1.35	1.30
Tension loads: concrete cone and splitting failure						
γ_{ins}	Installation safety factor: [1)]	[-]	1.2	1.0	1.2	1.0
h_{ef}	Effective embedment depth:	[mm]	57	82	56	86
$k_{ucr,N}$	Factor for uncracked concrete:	[-]	11.0			
$k_{cr,N}$	Factor for cracked concrete:	[-]	7.7			
$s_{cr,N}$	Critical spacing:	[mm]	3.0 x h_{ef}			
$c_{cr,N}$	Critical edge distance:	[mm]	1.5 x h_{ef}			
$s_{cr,sp}$	Critical spacing (splitting):	[mm]	3.0 x h_{ef}			
$c_{cr,sp}$	Critical edge distance (splitting):	[mm]	1.5 x h_{ef}			

[1)] In absence of other national regulations
[2)] Pull-out failure is not decisive

Table C2: Displacements under tension loads for ESSVE EUS concrete screw

Characteristic values of displacements under tension loads of design method A			Performance						
			EUS 7.5		EUS 10.5		EUS 12.5		
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	40	55	50	60	60	70	85
Displacements under tension loads in uncracked concrete									
N	Service tension load in uncracked concrete C20/25 to C50/60:	[kN]	2.4	3.6	4.4	4.8	5.7	9.5	12.3
δ_{N0}	Short term displacement under tension loads:	[mm]	0.06	0.40	0.08	0.40	0.09	0.40	0.12
$\delta_{N\infty}$	Long term displacement under tension loads:	[mm]	0.30	1.00	0.35	1.10	0.40	1.40	0.55
Displacements under tension loads in cracked concrete									
N	Service tension load in cracked concrete C20/25 to C50/60:	[kN]	1.2	2.4	2.5	3.6	4.0	5.7	8.6
δ_{N0}	Short term displacement under tension loads:	[mm]	0.10	0.60	0.12	0.70	0.15	0.50	0.17
$\delta_{N\infty}$	Long term displacement under tension loads:	[mm]	1.10	1.40	1.20	1.20	1.25	1.40	0.55

Characteristic values of displacements under tension loads of design method A			Performance			
			EUS 14.2		EUS 16.5	
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	75	105	75	110
Displacements under tension loads in uncracked concrete						
N	Service tension load in uncracked concrete C20/25 to C50/60:	[kN]	11.3	18.1	8.2	19.0
δ_{N0}	Short term displacement under tension loads:	[mm]	0.08	0.10	0.10	0.90
$\delta_{N\infty}$	Long term displacement under tension loads:	[mm]	0.40	0.40	0.45	1.40
Displacements under tension loads in cracked concrete						
N	Service tension load in cracked concrete C20/25 to C50/60:	[kN]	7.7	13.3	5.7	11.9
δ_{N0}	Short term displacement under tension loads:	[mm]	0.13	0.15	0.20	0.60
$\delta_{N\infty}$	Long term displacement under tension loads:	[mm]	1.25	1.35	1.32	1.20

Table C3: Characteristic values to shear loads of design method A

Characteristic values of resistance to shear loads			Performance						
			EUS 7.5		EUS 10.5		EUS 12.5		
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	40	55	50	60	60	70	85
Shear loads: steel failure without lever arm									
$V_{Rk,s}$	Shear steel characteristic resistance:	[kN]	9.3	7.5	16.3		25.6		
k_7	k_7 factor:		0.8		0.8		0.8		
γ_{Ms}	Partial safety factor: *)	[-]	1.25		1.25		1.25		
Shear loads: steel failure with lever arm									
$M^0_{Rk,s}$	Characteristic bending moment:	[Nm]	15.2		35.3		69.3		
γ_{Ms}	Partial safety factor: *)	[-]	1.25		1.25		1.25		
Shear loads: concrete pryout failure									
k_8	k_8 factor:	[-]	0.8	1.0	1.2	1.0	1.0	1.0	1.0
γ_{inst}	Installation safety factor: *)	[-]	1.0	1.5	1.0	1.5	1.0	1.5	1.0
Shear loads: concrete edge failure									
l_f	Effective anchorage depth under shear loads:	[mm]	29	42	37	45	44	52	65
d_{nom}	Nominal outer diameter of screw:	[mm]	6	6	8	8	10	10	10
γ_{inst}	Installation safety factor: *)	[-]	1.2	1.5	1.2	1.5	1.2	1.5	1.0

*) In absence of other national regulations

Characteristic values of resistance to shear loads			Performance			
			EUS 14.2		EUS 16.5	
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	75	105	75	110
Shear loads: steel failure without lever arm						
$V_{Rk,s}$	Shear steel characteristic resistance:	[kN]	40.3		57.9	
k_7	k_7 factor:		0.8		0.8	
γ_{Ms}	Partial safety factor: *)	[-]	1.25		1.25	
Shear loads: steel failure with lever arm						
$M^0_{Rk,s}$	Characteristic bending moment:	[Nm]	137.1		235.9	
γ_{Ms}	Partial safety factor: *)	[-]	1.25		1.25	
Shear loads: concrete pryout failure						
k_8	k_8 factor:	[-]	1.5		1.6	2.0
γ_{inst}	Installation safety factor: *)	[-]	1.25		1.0	1.5
Shear loads: concrete edge failure						
l_f	Effective anchorage depth under shear loads:	[mm]	57	82	56	86
d_{nom}	Nominal outer diameter of screw:	[mm]	12	12	14	14
γ_{inst}	Installation safety factor: *)	[-]	1.2	1.0	1.2	1.5

*) In absence of other national regulations

Table C4: Displacements under shear loads

Characteristic values of displacements under shear loads of design method A			Performances						
			EUS 7.5		EUS 10.5		EUS 12.5		
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	40	55	50	60	60	70	85
Displacements under shear loads in uncracked concrete									
V	Service shear load in cracked and uncracked concrete C20/25 to C50/60:	[kN]	3.0	3.6	4.4	4.8	5.7	9.5	12.3
δ_{V0}	Short term displacement under shear loads:	[mm]	0.47	0.4	0.50	0.40	0.40	0.40	0.80
$\delta_{V\infty}$	Long term displacement under shear loads:	[mm]	0.70	1.0	0.75	1.10	0.60	1.40	1.20
Displacements under shear loads in cracked concrete									
V	Service shear load in cracked and uncracked concrete C20/25 to C50/60:	[kN]	2.1	2.4	3.1	3.6	4.0	5.7	8.6
δ_{V0}	Short term displacement under shear loads:	[mm]	0.40	0.60	0.45	0.70	0.50	0.50	0.6
$\delta_{V\infty}$	Long term displacement under shear loads:	[mm]	0.60	1.40	0.67	1.20	0.75	1.40	0.90

Characteristic values of displacements under shear loads of design method A			Performances			
			EUS 14.2		EUS 16.5	
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	75	105	75	110
Displacements under shear loads in uncracked concrete						
V	Service shear load in cracked and uncracked concrete C20/25 to C50/60:	[kN]	8.4	17.4	8.2	19.0
δ_{V0}	Short term displacement under shear loads:	[mm]	1.00	1.10	0.55	0.90
$\delta_{V\infty}$	Long term displacement under shear loads:	[mm]	1.50	1.80	0.82	1.4
Displacements under shear loads in cracked concrete						
V	Service shear load in cracked and uncracked concrete C20/25 to C50/60:	[kN]	5.9	12.2	5.7	11.9
δ_{V0}	Short term displacement under shear loads:	[mm]	0.85	1.00	0.50	0.60
$\delta_{V\infty}$	Long term displacement under shear loads:	[mm]	1.20	1.50	0.75	1.20

Information for design of anchorages under shear loads:

The conditions given in EN 1992-4:2018 are not fulfilled because the diameter of the clearance hole in the fixture (see “Installation parameters” table B1) is greater than the values given in EN 1992-4 Table 6.1 for the corresponding diameter of the anchor. Therefore, condition EN 1992-4 6.2.2.2(1) a) 2) is not valid for shear steel failure for anchors groups (n > 1). Consequently, it is assumed that for the proof of steel failure, only two anchors of a group are effective and take up shear forces."

Table C5: Essential characteristics for seismic performance category C1

Essential characteristics for seismic performance category C1				Performances		
				EUS 10.5	EUS 12.5	EUS 16.5
h_{nom}	Overall anchor embedment depth in the concrete:		[mm]	60	85	110
Steel failure for tension and shear loads						
$N_{Rk,s,C1}$	Characteristic resistance:		[kN]	32.7	51.2	115.9
γ_{Ms}	Partial safety factor [1]:		[--]	1.5	1.5	1.5
$V_{Rk,s,C1}$	Characteristic resistance:		[kN]	16.3	24.3	57.9
γ_{Ms}	Partial safety factor [1]:		[--]	1.25	1.25	1.25
Pull out failure						
$N_{Rk,p,C1}$	Characteristic resistance in cracked concrete:		[kN]	9.0	24.0	30.0
γ_{inst}	Robustness:		[--]	1.8	1.8	1.5
Concrete cone failure						
h_{ef}	Effective embedment depth:		[mm]	45	65	86
$s_{cr,N}$	Concrete	Spacing:	[mm]	135	195	258
$c_{cr,N}$	cone failure	Edge distance:	[mm]	67	98	129
γ_{inst}	Installation safety factor:		[--]	1.2	1.0	1.0
Concrete pry-out failure						
k_8	Pry-out factor:		[--]	1.0	0.9	1.5
γ_{inst}	Installation safety factor:		[--]	1.2	1.0	1.0
Concrete edge failure						
$\ell_f = h_{ef}$	Effective length of fastener under shear loads:		[mm]	45	65	86
d_{nom}	Nominal outer diameter of screw:		[mm]	8	10	14
γ_{inst}	Installation safety factor:		[--]	1.0	1.0	1.0

[1] In absence of other national regulations

Table C6: Essential characteristics for seismic performance category C2

Essential characteristics for seismic performance category C2				Performances	
				EUS 12.5	EUS 16.5
h_{nom}	Overall anchor embedment depth in the concrete:		[mm]	85	110
Steel failure for tension and shear loads					
$N_{Rk,s,C2}$	Characteristic resistance:		[kN]	51.2	115.9
γ_{Ms}	Partial safety factor [1]:		[--]	1.5	1.5
$V_{Rk,s,C2}$	Characteristic resistance:		[kN]	16.1	41.1
γ_{Ms}	Partial safety factor [1]:		[--]	1.25	1.25
Pull out failure					
$N_{Rk,p,C2}$	Characteristic resistance in cracked concrete:		[kN]	11.0	9.6
γ_{inst}	Robustness:		[--]	1.8	1.5
Concrete cone failure					
h_{ef}	Effective embedment depth:		[mm]	65	86
$s_{cr,N}$	Concrete	Spacing:	[mm]	195	258
$c_{cr,N}$	cone failure	Edge distance:	[mm]	98	129
γ_{inst}	Installation safety factor:		[--]	1.0	1.0
Concrete pry-out failure					
k_8	Pry-out factor:		[--]	0.92	1.5
γ_{inst}	Installation safety factor:		[--]	1.0	1.0
Concrete edge failure					
$\ell_f = h_{ef}$	Effective length of fastener under shear loads:		[mm]	65	86
d_{nom}	Nominal outer diameter of screw:		[mm]	10.0	14.0
γ_{inst}	Installation safety factor:		[--]	1.0	1.0
Displacements					
$\delta_{N,C2\ (DLS)}$	Displacement at		[mm]	0.35	0.73
$\delta_{V\ C2\ (DLS)}$	Damage Limitation State:[2]		[mm]	5.16	5.67
$\delta_{N,C2\ (ULS)}$	Displacement at		[mm]	1.11	2.06
$\delta_{V,C2\ (ULS)}$	Ultimate Limitation State:[2]		[mm]	7.90	7.90

DLS: Damage Limitation State: see EN 1992-4, 2.2.1)
ULS: Ultimate Limitation State: see EN 1992-4 2.2.1)

[1] In absence of other national regulations
[2] The listed displacements represent mean values

Table D1: Characteristic values to fire resistance

Fire resistance duration = 30 minutes			EUS 7.5	EUS 10.5	EUS 12.5	EUS 16.5
Tension loads, steel failure						
$N_{Rk,s,fi,30}$	Characteristic resistance	[kN]	0.23	0.61	1.28	2.90
Pull-out failure						
$N_{Rk,p,fi,30}$	Character. resistance in concrete C20/25 to C50/60	[kN]	1.50	2.25	3.00	7.50
Concrete cone failure **)						
$N_{Rk,c,fi,30}$	Character. resistance in concrete C20/25 to C50/60	[kN]	2.06	2.45	3.51	12.35
Shear loads steel failure without lever arm						
$V_{Rk,s,fi,30}$	Characteristic resistance	[kN]	0.23	0.61	1.28	2.90
Shear loads, steel failure with lever arm						
$M_{Rk,s,fi,60}$	Characteristic bending resistance	[Nm]	0.19	0.66	1.73	5.90

Fire resistance duration = 60 minutes			EUS 7.5	EUS 10.5	EUS 12.5	EUS 16.5
Tension loads, steel failure						
$N_{Rk,s,fi,60}$	Characteristic resistance	[kN]	0.21	0.53	0.96	2.17
Pull-out failure						
$N_{Rk,p,fi,60}$	Character. resistance in concrete C20/25 to C50/60	[kN]	1.50	2.25	3.00	7.50
Concrete cone failure **)						
$N_{Rk,c,fi,60}$	Character. resistance in concrete C20/25 to C50/60	[kN]	2.06	2.45	3.51	12.35
Shear loads, steel failure without lever arm						
$V_{Rk,s,fi,60}$	Characteristic resistance	[kN]	0.21	0.53	0.96	2.17
Shear loads, steel failure with lever arm						
$M_{Rk,s,fi,60}$	Characteristic bending resistance	[Nm]	0.17	0.57	1.30	4.42

Fire resistance duration = 90 minutes			EUS 7.5	EUS 10.5	EUS 12.5	EUS 16.5
Tension loads, steel failure						
$N_{Rk,s,fi,90}$	Characteristic resistance	[kN]	0.16	0.41	0.83	1.88
Pull-out failure						
$N_{Rk,p,fi,90}$	Character. resistance in concrete C20/25 to C50/60	[kN]	1.50	2.25	3.00	7.50
Concrete cone failure **)						
$N_{Rk,c,fi,90}$	Character. resistance in concrete C20/25 to C50/60	[kN]	2.06	2.45	3.51	12.35
Shear loads, steel failure without lever arm						
$V_{Rk,s,fi,90}$	Characteristic resistance	[kN]	0.16	0.41	0.83	1.88
Shear loads, steel failure with lever arm						
$M_{Rk,s,fi,90}$	Characteristic bending resistance	[Nm]	0.13	0.44	1.13	3.83

Fire resistance duration = 120 minutes			EUS 7.5	EUS 10.5	EUS 12.5	EUS 16.5
Tension loads, steel failure						
$N_{Rk,s,fi,120}$	Characteristic resistance	[kN]	0.12	0.33	0.64	1.45
Pull-out failure						
$N_{Rk,p,fi,120}$	Character. resistance in concrete C20/25 to C50/60	[kN]	1,20	1.80	2.40	6.00
Concrete cone failure **)						
$N_{Rk,c,fi,120}$	Character. resistance in concrete C20/25 to C50/60	[kN]	1.65	1.96	2.81	9.88
Shear loads, steel failure without lever arm						
$V_{Rk,s,fi,120}$	Characteristic resistance	[kN]	0.12	0.33	0.64	1.45
Shear loads, steel failure with lever arm						
$M_{Rk,s,fi,120}$	Characteristic bending resistance	[Nm]	0.10	0.35	0.87	2.95

Spacing and edge distances			EUS 7.5	EUS 10.5	EUS 12.5	EUS 16.5
$S_{cr,N}$	Spacing	[mm]	168	180	208	344
S_{min}	Minimum spacing	[mm]	45	50	60	100
$C_{cr,N}$	Edge distance	[mm]	84	90	104	172
C_{min}	Minimum edge distance (one side fire)	[mm]	84	90	104	172
C_{min}	Minimum edge distance (two sides fire)	[mm]	300	300	300	300
γ_{Msp}	Partial safety factor*)	[-]	1.0	1.0	1.0	1.0

*) In absence of other national regulations
**) As a rule, splitting failure can be neglected when cracked concrete and reinforcement is assumed.

Concrete pry-out failure		EUS 7.5	EUS 10.5	EUS 12.5	EUS 16.5
k factor	[--]	1	1	1	2
According EN 1992-4:2018, these values of k factor and the relevant values of $N_{Rk,c,fi}$ given in the above tables have to be considered in the design.					

Concrete edge failure

The characteristic resistance $V^0_{RK,c,fi}$ in C20/25 to C50/60 concrete is determined by:
$V^0_{RK,c,fi} = 0.25 \times V^0_{RK,c}$ (≤ R90) and $V^0_{RK,c,fi} = 0.20 \times V^0_{RK,c}$ (R120)
With $V^0_{RK,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature according to EN 1992-4:2018.