DECLARATION OF PERFORMANCE

No: 18-EUS [EN]

Unique identification code of the product-type:

ESSVE Concrete screw EUS (carbon steel)

Manufacturer:

ESSVE Produkter AB
BOX 7091
164 07 Kista
Sweden

European Technical Assessment (ETA)	Intended use	Outer diameter and (drill) dimension [mm]	Material	Article numbers
ETA-18/1064 (2022-10-11)	Single anchor or anchor groups for use in structural applications under static or quasi-static actions in cracked and uncracked concrete. ○ Reinforced or unreinforced normal weight concrete according to EN 206-1 ○ Concrete strength classes C20/25 to C50/60 according to EN 206-1	7,5(6)	Carbon steel, Zinc plated / RUSPERT	All article numbers in the product group are covered by the ETA.
		10,5(8)		
		12,5(10)		
		16,5(14)		
ETA-22/0639 (2022-09-15)	Screw anchors in precast prestressed hollow core slabs for redundant non-structural systems.	7,5(6)		
	Screw anchors for use in concrete for redundant non-structural systems.	7,5(6)		
		10,5(8)		
		12,5(10)		
		16,5(14)		

European Technical Assessment (ETA)	System of AVCP	European Assessment Document	Technical Assessment Body (TAB)	Notified Body (NB)
ETA-18/1064 (2022-10-11)	1	EAD 330232-01-0601, (2019-12)	Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)	1219 (FPC)
ETA-22/0639 (2022-09-15)	2+	EAD 330747-00-0601, (2018-05)	Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)	1219 (FPC)

DECLARATION OF PERFORMANCE

No: 18-EUS [EN]

European Technical Assessment (ETA)	Essential characteristics	Declared performance
ETA-18/1064 (2022-10-11)	Characteristic resistance to tension and shear load (static and quasi-static loading)	ETA-18/1064 Annex C
	Characteristic resistance and displacements for seismic performance categories C1 and C2	ETA-18/1064 Annex C6 – C7
	Reaction to fire	Class A1
	Resistance to fire	ETA-18/1064 Annex D
ETA-22/0639 (2022-09-15)	Reaction to fire	Class A1
	Resistance to fire	ETA-22/0639 Annex D
	Characteristic resistance to tension and shear load (static and quasi-static loading)	ETA-22/0639 Annex C

The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer above.

Signed for and on behalf of the manufacturer by:

Kista 2023-12-11

Viktor Bukowski
Product Manager – Concrete Fasteners

[ETA documents attached as appendices]

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

Member of EOTA
www.eota.eu

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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
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

C/ Serrano Galvache n.º 4. 28033 Madrid.
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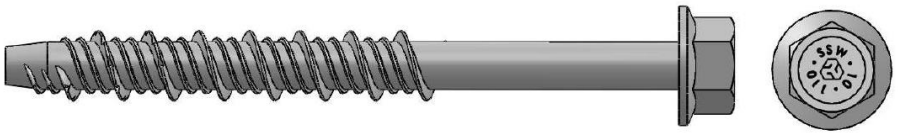
https://dit.ietcc.csic.es

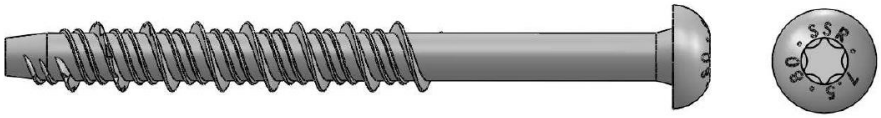
On behalf of the Instituto de Ciencias de la Construcción Eduardo Torroja
Madrid, 11th of October 2022

Director IETcc-CSIC

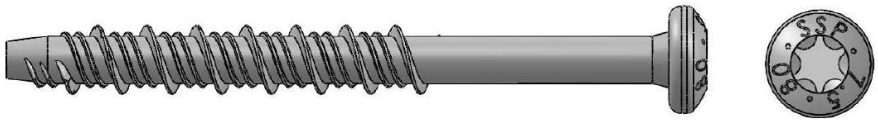
Product and identification



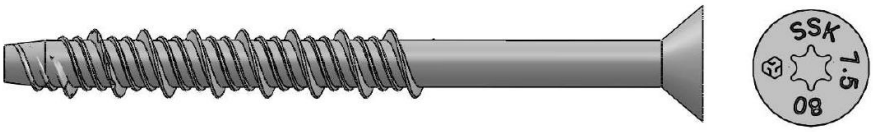
EUS - SSW



EUS - SSR



EUS - SSP



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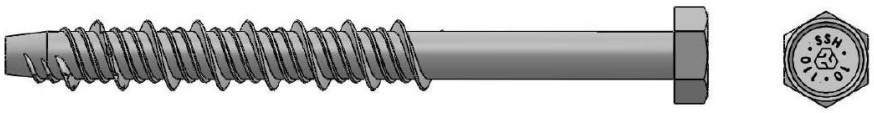
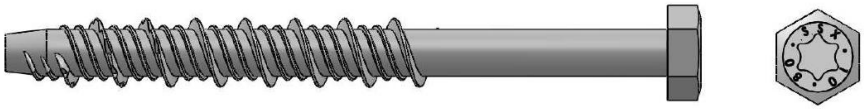
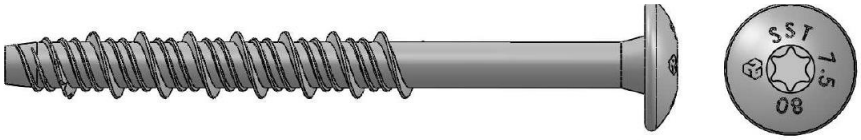


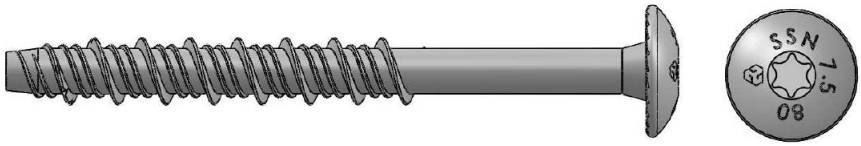
EUS - SSH



EUS - SSX



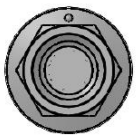
EUS - SST



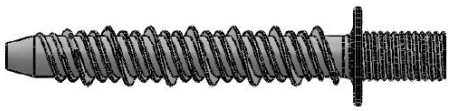
EUS - SSN

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

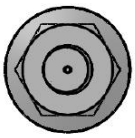
EUS - SSD

EUS - SSI

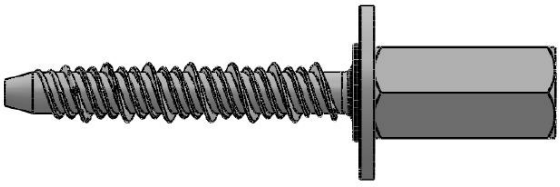
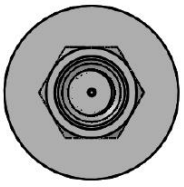



EUS - SSF

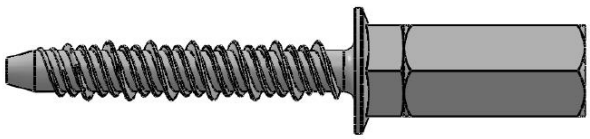
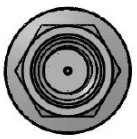



EUS - SSO

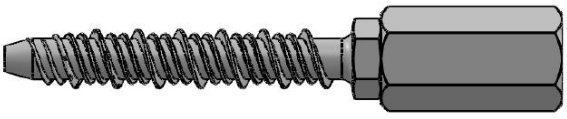

EUS - SSU

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

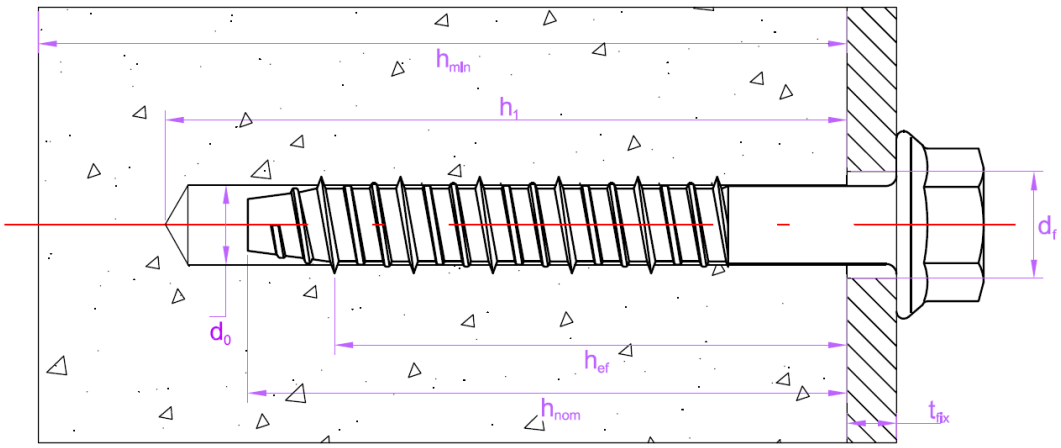
ESSVE EUS concrete screw	
Product description Identification	**Annex A3**

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.

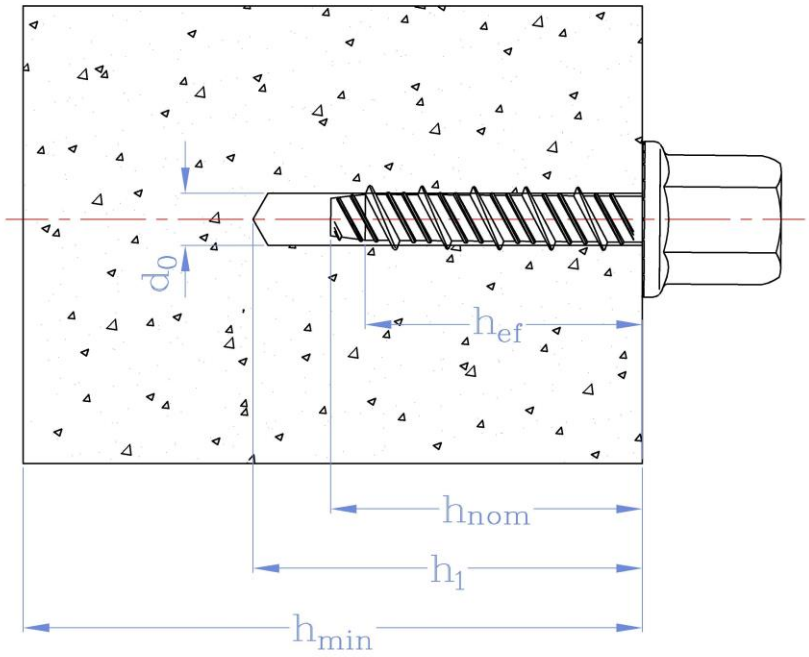
Installed condition

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

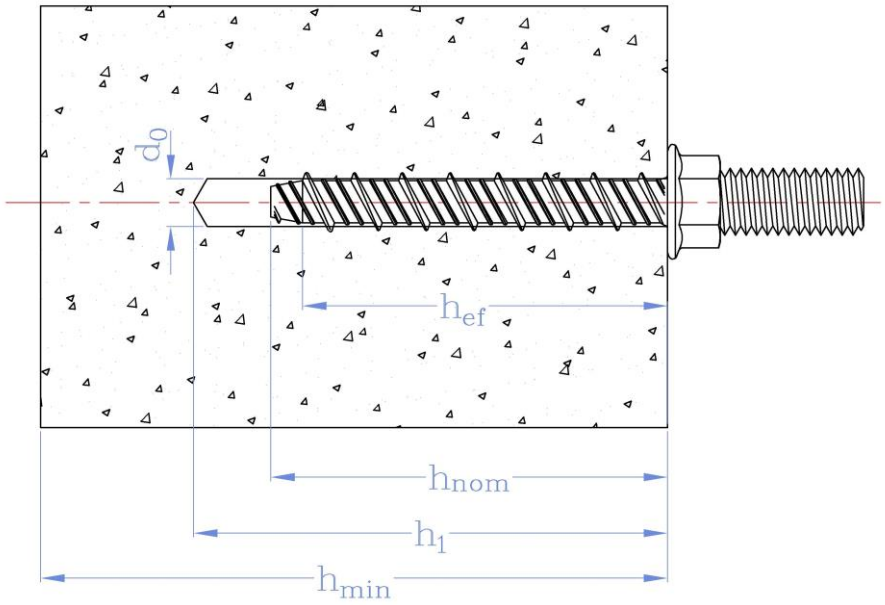


Drawing A1. Installed condition for anchors EUS - SSW, EUS - SSR, EUS - SSP, EUS - SSK, EUS - SSH, EUS - SSX, EUS - SST, EUS - SSN and EUS - SSC.

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:

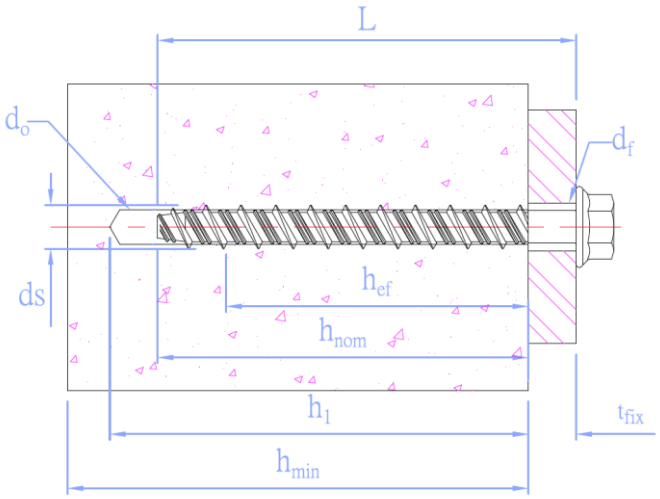
- Hammer drilling only.
- Anchor installation carried out by appropriately qualified personal and under the supervision of the person responsible for technical matters of the site.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of aborted hole or smaller distance 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

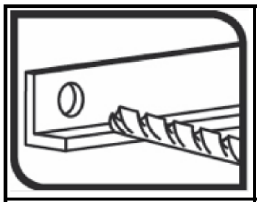
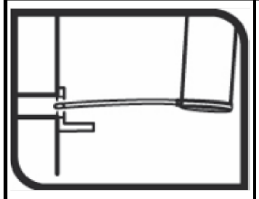
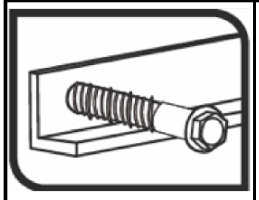
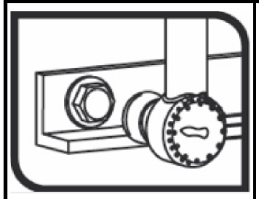
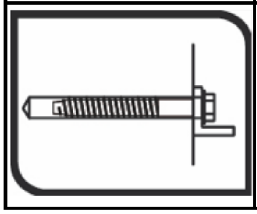
Installation parameters			Performance						
			EUS 7.5		EUS 10.5		EUS 12.5		
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	40	55	50	60	60	70	85
d_0	Nominal diameter of drill bit:	[mm]	6		8		10		
d_f	Diameter of clearance hole in fixture:	[mm]	9		12		14		
d_s	Outer diameter of the thread	[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.

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Designated according to Article29 of Regulation (EU) Nº 305/2011

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European Technical Assessment

ETA 22/0639
of 15/09/2022

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**
Product family to which the construction product belongs:	Screw anchor of sizes 7.5, 10.5, 12.5 and 16.5 for use in concrete and in precast prestressed hollow core slabs for redundant non-structural systems
Manufacturer:	**ESSVE Produkter AB.** Esbogatan 14, 164 74 Kista, Sweden. website: www.essve.com
Manufacturing plant:	**Plant no. 421**
This European Technical Assessment contains:	18 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 330747-00-0601 “Fasteners for use in concrete for redundant non-structural systems”, ed. May 2018

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.

SPECIFIC PART

1. Technical description of the product

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

Product and installation descriptions are given in annex 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 mean 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 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for class A1 according to EN 13501-7
Resistance to fire	See annex D

3.2 Safety in use (BWR 4)

Essential characteristic	Performance
Characteristic resistance under static or quasi static loading	See annex C

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 Performance (see annex V to Regulation (EU) No 305/2011) is 97/161/EC.

The system to be applied is 2+.

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.

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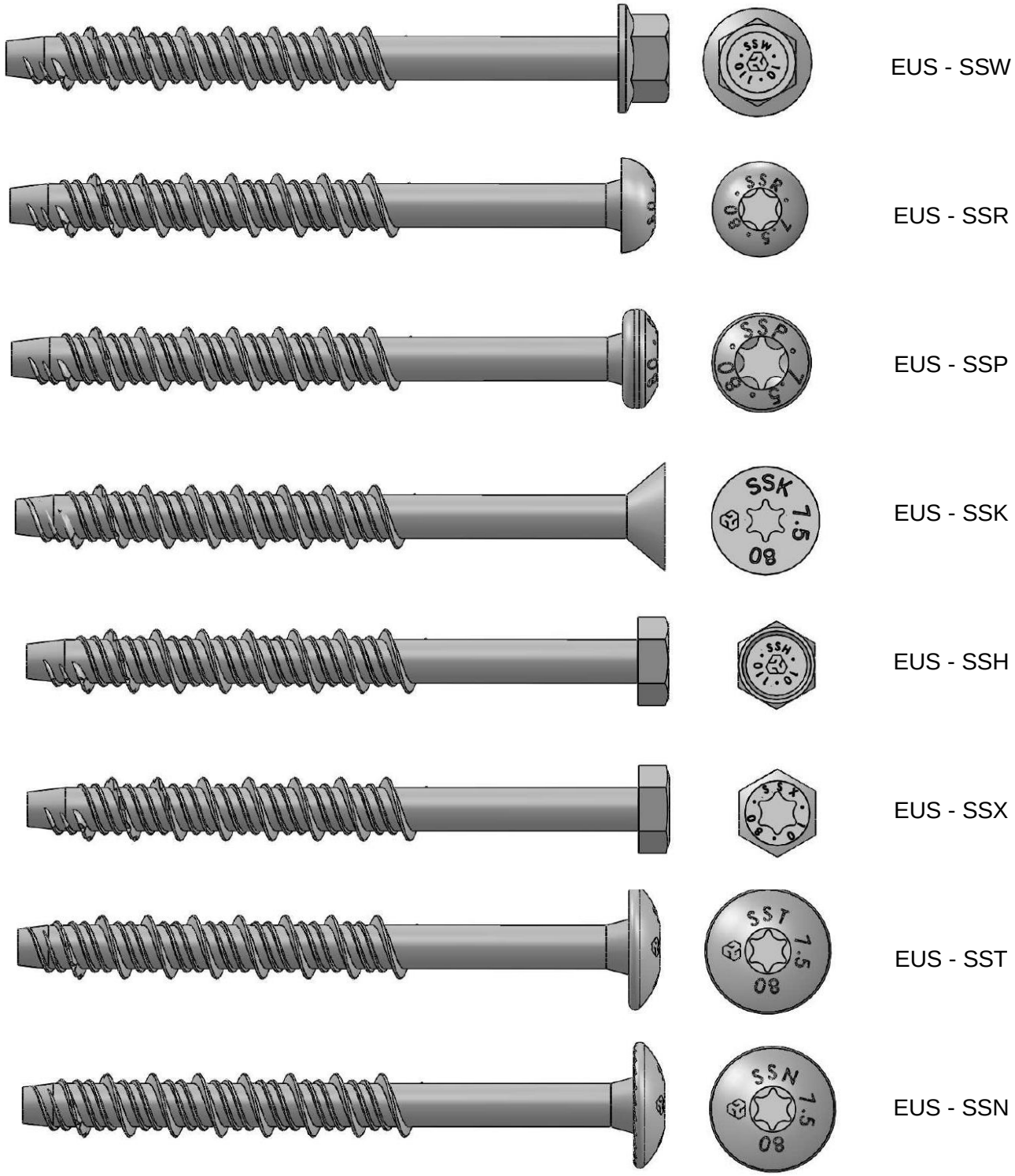
On behalf of the Instituto de Ciencias de la Construcción Eduardo Torroja
Madrid, 15th of September 2022

Director IETcc-CSIC

Product and identification



EUS - SSW

EUS - SSR

EUS - SSP

EUS - SSK

EUS - SSH

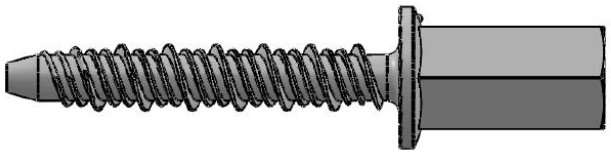
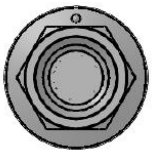
EUS - SSX

EUS - SST

EUS - SSN

Anchor ESSVE EUS	**Annex A1**
Product description Identification	

EUS - SSD

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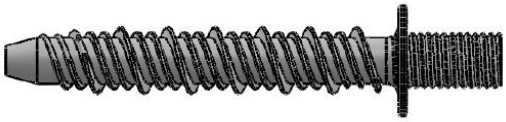
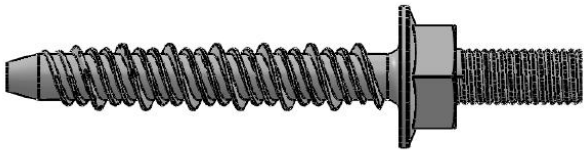
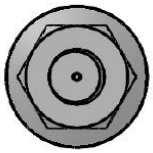
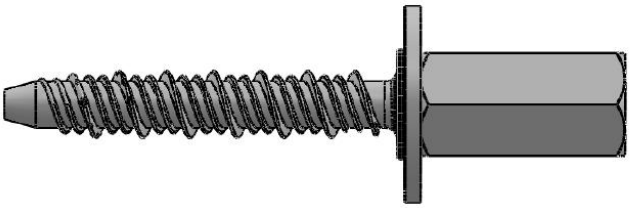
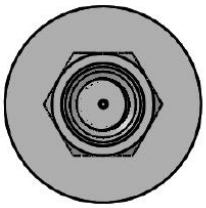



EUS - SSF

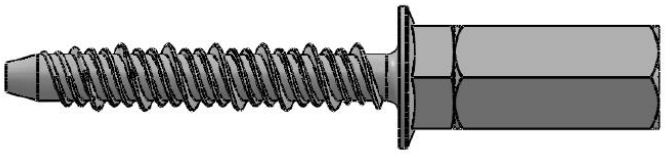
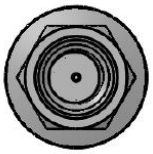



EUS - SSO

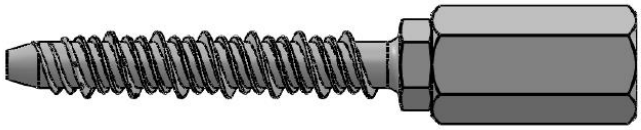

EUS - SSU

EUS - SSG

EUS - SSQ




EUS - SSV

Anchor ESSVE EUS	
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

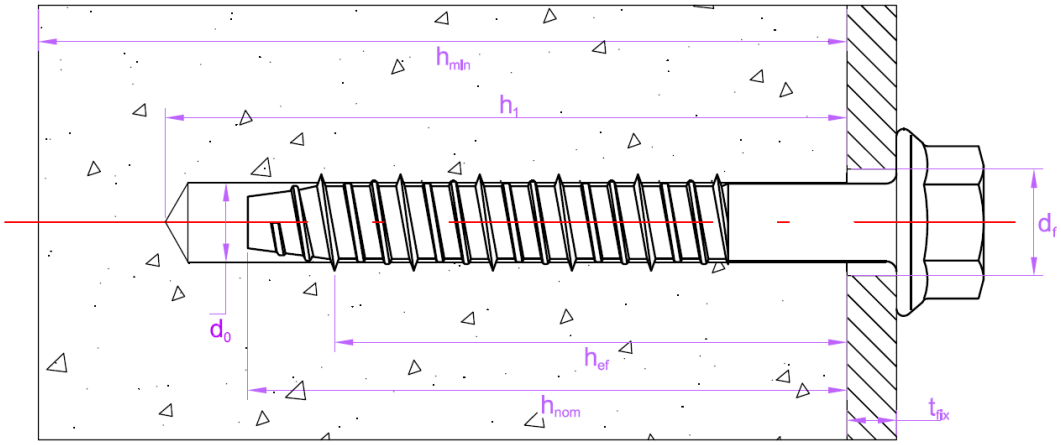
Anchor ESSVE EUS	
Product description Identification	**Annex A3**

Table A1: Materials

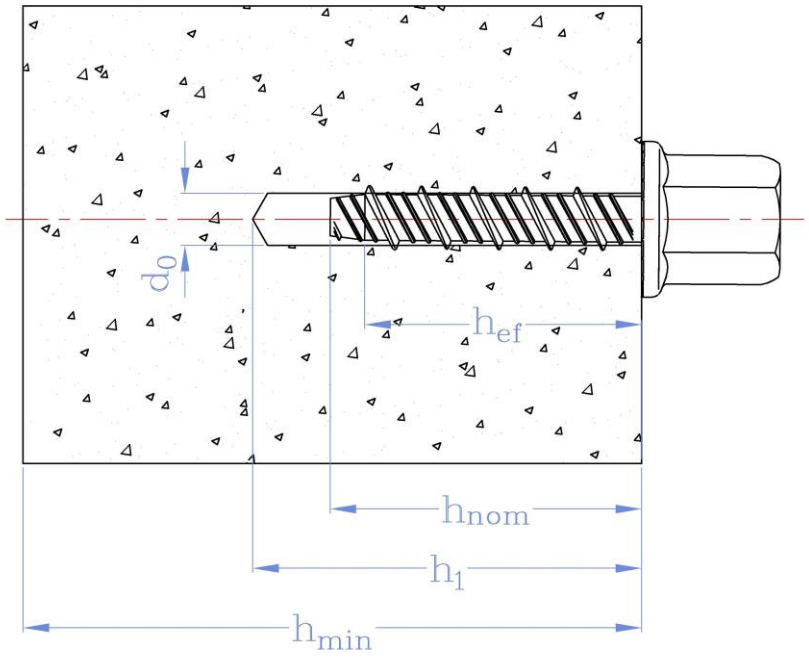
Item	Designation	ESSVE EUS concrete screw
1	Anchor Body	Carbon steel wire rod cold forged. Allowed coatings: • Zinc plated ISO 4042 • Silver ruspert • Zinc flake EN 10683 • Mechanical galvanizing

Installed condition

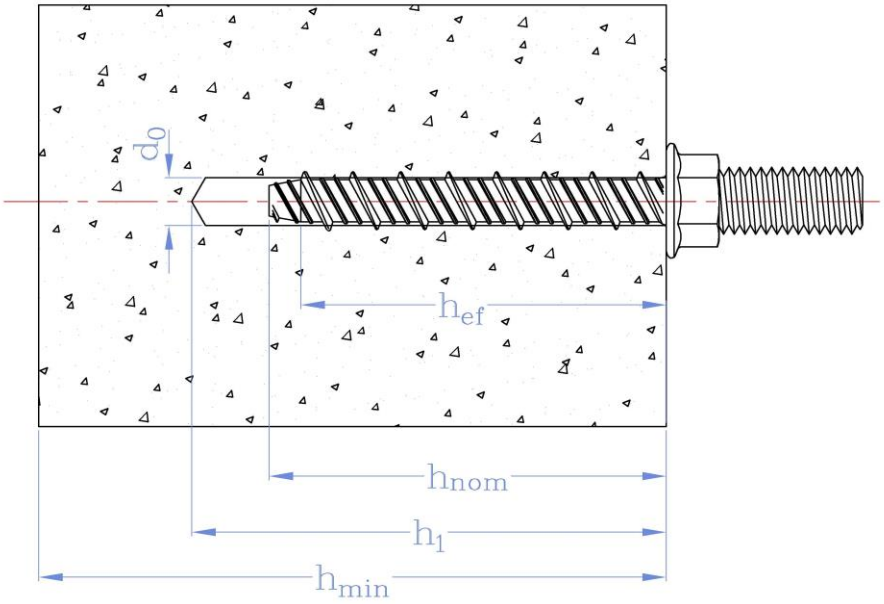
h_{ef}: Effective anchorage depth
h_1: Depth of drilled hole
h_{nom}: Overall anchor embedment depth in the concrete
h_{min}: Minimum thickness of concrete member
t_{fix}: Thickness of fixture
d_0: Nominal diameter of drill bit
d_f: Diameter of clearance hole in fixture



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

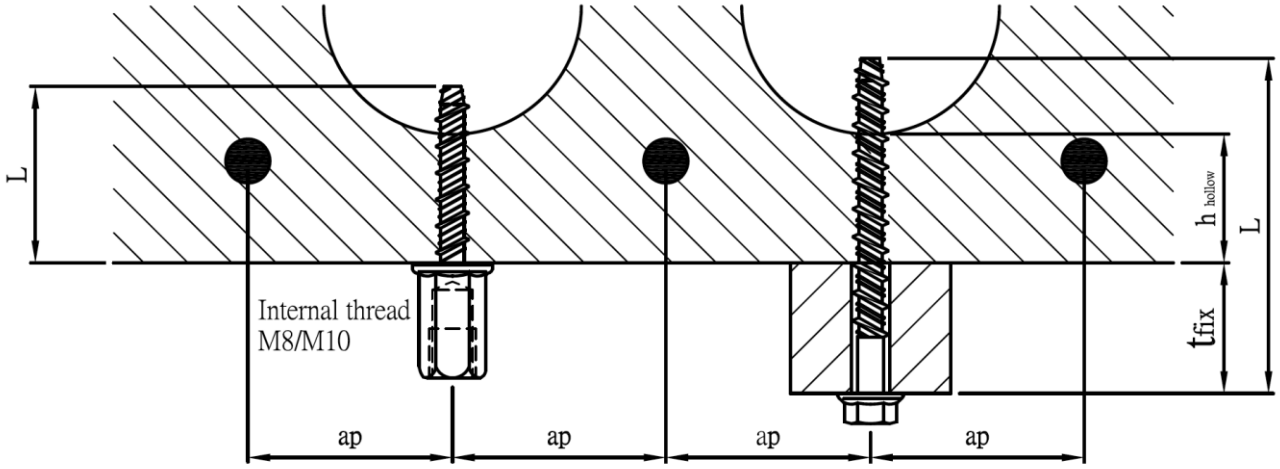


Drawing A2. Installed condition for anchors EUS - SSD, EUS - SSI, EUS - SSF, EUS - SSO, EUS - SSU, EUS - SSG, EUS - SSQ, EUS - SSV and EUS - SSG2



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

Anchor ESSVE EUS	
Product description Installed condition in concrete	**Annex A5**



Drawing A4. Installed condition in prestressed hollow core concrete slabs

ap: Distance between anchor position and prestressing steel (≥ 50 mm).
L: Screw anchor length
h_{hollow}: Thickness of hollow core concrete slab ≥ 25 mm
t_{fix}: Fixture thickness (≥ L – h_{hollow} , where h_{hollow} = 25 mm if h_{hollow} is unknown)
w: Core width
e: Web thickness

Note that $^{w}/_{e} \leq 4{,}2$

Anchor ESSVE EUS	
Product description Installed condition in prestressed hollow core concrete slabs	**Annex A6**

Specifications of intended use

Anchorages subjected to:

- Static or quasi static loads for redundant non-structural systems
- Use for anchorages with requirements related to resistance of fire (not for using in prestressed hollow core slabs)
- The anchor may only be used if in the design and installation specifications for the fixture the excessive slip or failure of one anchor will not result in a significant violation of the requirements on the fixture in the serviceability and ultimate state.

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206:2013.
- Strength classes C20/25 to C50/60 according to EN 206:2013.
- Cracked or uncracked concrete.
- Precast, prestressed hollow core concrete slabs, strength C30/37 according to EN 206:2013

Use conditions (environmental conditions):

- Anchorages subjected to dry internal conditions.

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation rules and drawings are prepared taking into account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e.g. position of the fastener relative to reinforcement or to supports, etc.).
- Anchorages under static or quasi-static actions are designed for design method A in accordance with EN 1992-4:2018.
- 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.

Installation:

- Hole drilling by rotary plus hammer mode.
- Fastener 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 must not be possible.
- The head of the fastener must be supported on the fixture and is not damaged.
- In precast pre-stressed hollow core slabs, the screw may be installed from all directions, if the web thickness and the spacing to the tensioning strands are defined according to Table B2
- Shear assessment only covers the shear force induced by the fixtured piece, i.e. the piece located between the anchor head and the concrete block (piece contained in t_{fix}, see Drawings A1 and A4).

Anchor ESSVE EUS	**Annex B1**
Intended use Specifications	

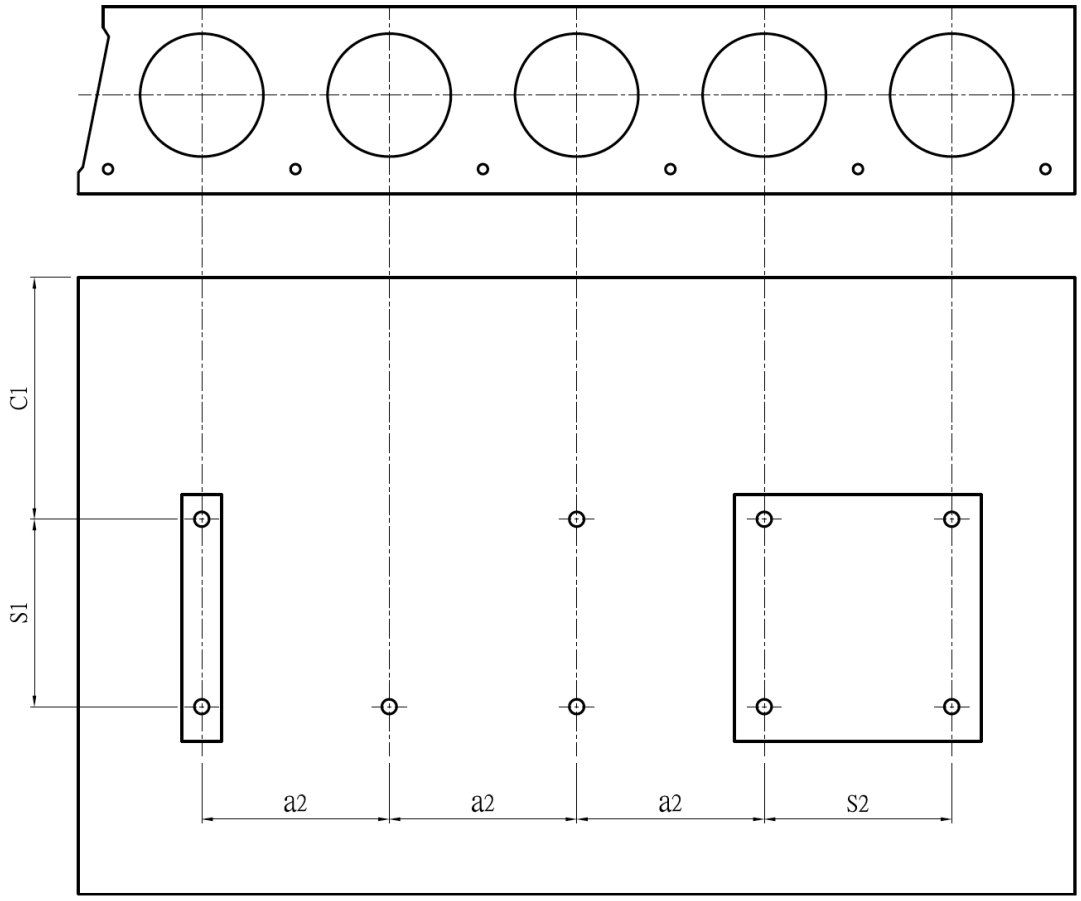
Table B1: Installation parameters in concrete

Installation parameters			Performance				
			EUS7.5		EUS10.5	EUS12.5	EUS16.5
d_0	Nominal diameter of drill bit:	[mm]	6	6	8	10	14
d_f	Diameter of clearance hole in fixture:	[mm]	9	9	12	14	18
d_s	Outer diameter of the thread	[mm]	7.5	7,5	10,5	12,5	16,5
L_{min}	Total length of the anchor (L)	[mm]	40	55	50	60	75
L_{max}		[mm]	400	400	400	400	400
h_{min}	Minimum thickness of concrete member:	[mm]	80	90	90	100	120
h_1	Depth of drilled hole:	[mm]	L+10	L+10	L+10	L+10	L+15
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	40	55	50	60	75
h_{ef}	Effective anchorage depth:	[mm]	29	42	37	44	56
T_{ins}	Installation torque	[Nm]	15	15	25	50	80
t_{fix}	Thickness of fixture	[mm]	L-40	L-55	L-50	L-60	L-75
s_{min}	Minimum allowable spacing:	[mm]	35	35	35	50	75
c_{min}	Minimum allowable edge distance:	[mm]	35	35	35	40	45

Table B2: Installation parameters in prestressed hollow core concrete slabs

Installation parameters			Performance		
			EUS7.5		
d_0	Nominal diameter of drill bit:	[mm]	6		
d_f	Diameter of clearance hole in fixture:	[mm]	9		
d_s	Outer diameter of the thread	[mm]	7,5		
L_{min}	Total length of the anchor (L)	[mm]	> h_{hollow}		
L_{max}		[mm]	400		
h_{hollow}	Minimum concrete thickness with hollow	[mm]	35	30	25
h_{ef}	Effective anchorage depth:	[mm]	27	23	19
T_{ins}	Installation torque	[Nm]	15		
t_{fix}	Thickness of fixture	[mm]	≥ L - 35	≥ L - 30	≥ L - 25
s_{min}	Minimum allowable spacing:	[mm]	100		
c_{min}	Minimum allowable edge distance:	[mm]	100		

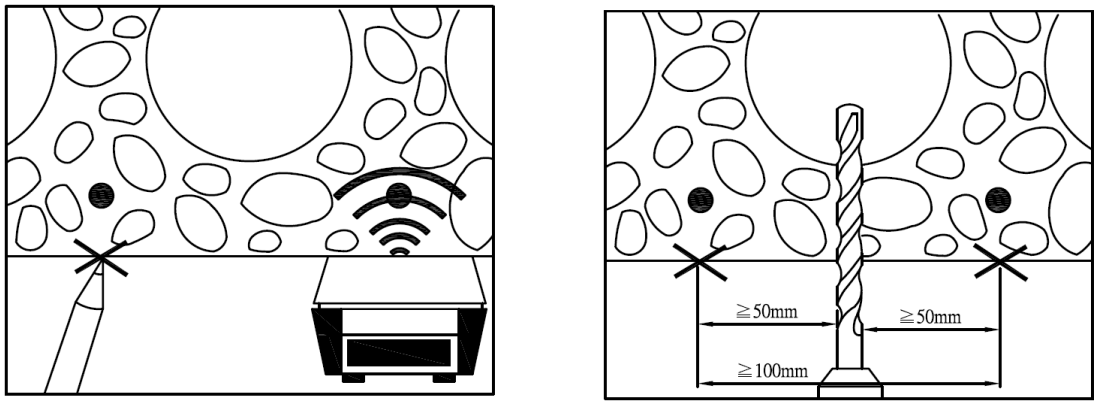
Installation process in prestressed hollow core concrete slabs



Drawing B3. Installation parameter for anchorage in precast prestressed hollow core slabs

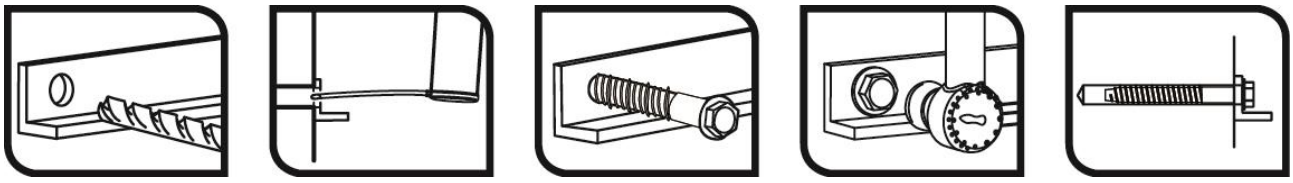
c_1, c_2: Edge distance
s_1, s_2: Anchor spacing
a_1, a_2: Distance between anchor groups
c_{min}: Minimum edge distance ≥ 100 mm
s_{min}: Minimum anchor spacing ≥ 100 mm
a_{min}: Minimum distance between anchor groups ≥ 100 mm

Drawing B4 shows the installation steps for prestressed hollow core concrete slabs. Firstly, determine and mark positions of the tensioning strands, and then keep distance.



Drawing B4. Installation process in prestressed hollow core concrete slabs

Installation process



Drawing B5. Installation process

Anchor shall be installed using a torque wrench or an electrical impact driver; power input: 500 W; torque: 50-250 Nm. (e.g: Bosch GDS 18E)

Table C1: Characteristic values to tension loads of design method A according to EN 1992-4

Characteristic values of resistance to tension loads of design method A			Performance				
			EUS7.5		EUS10.5	EUS12.5	EUS16.5
h_{nom}	Nominal embedment depth:	[mm]	40	55	50	60	75
Tension loads: steel failure							
$N_{Rk,s}$	Tension steel characteristic resistance:	[kN]	18,6	18,6	32,6	51,2	115,8
γ_{Ms}	Partial safety factor:[1)]	[-]	1,5				
Tension loads: pull-out failure in concrete							
$N_{Rk,p}$	Characteristic resistance in C20/25 cracked and uncracked concrete:	[kN]	4,0		[2)]		
ψ_c	C30/37	[-]	1,16	1,16	1,16	1,14	1,13
	C40/45	[-]	1,29	1,29	1,28	1,25	1,24
	C50/60	[-]	1,40	1,40	1,39	1,34	1,33
Tension loads: concrete cone and splitting failure							
h_{ef}	Effective embedment depth:	[mm]	29	42	37	44	56
$k_{ucr,N}$	Factor for uncracked concrete:	[-]	11,0				
$k_{cr,N}$	Factor for cracked concrete:	[-]	7,7				
$s_{cr,N}$	Critical spacing (concrete cone failure):	[mm]	$3,0 \times h_{ef}$				
$c_{cr,N}$	Critical edge distance (concrete cone failure):	[mm]	$1,5 \times h_{ef}$				
$s_{cr,sp}$	Critical spacing (splitting failure):	[mm]	87	126	111	132	168
$c_{cr,sp}$	Critical edge distance (splitting failure):	[mm]	44	63	56	66	84
γ_{inst}	Robustness:	[-]	1,2	1,2	1,2	1,2	1,2

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

Table C2: Characteristic values to shear loads of design method A according to EN 1992-4

Characteristic values of resistance to shear loads of design method A			Performance				
			EUS7.5		EUS10.5	EUS12.5	EUS16.5
h_{nom}	Nominal embedment depth:	[mm]	40	55	50	60	75
Shear loads: steel failure without lever arm							
$V_{Rk,s}$	Characteristic resistance:	[kN]	9,3		16,3	25,6	57,9
k_7	Ductility factor:	[-]	0,80		0,80	0,80	0,80
γ_{Ms}	Partial safety factor: [1)]	[-]	1,25				
Shear loads: steel failure with lever arm							
$M^0_{Rk,s}$	Characteristic bending moment:	[Nm]	15,2		35,3	69,3	235,9
γ_{Ms}	Partial safety factor: [*)]	[-]	1,25				
Shear loads: concrete pry-out failure							
k_8	Pray-out factor:	[-]	0,8		1,2	1,0	1,6
γ_{inst}	Installation safety factor: [1)]	[-]	1,0				
Shear loads: concrete edge failure							
l_f	Effective anchorage depth under shear loads:	[mm]	29		37	44	56
d_{nom}	Outside anchor diameter:	[mm]	6		8	10	14
γ_{inst}	Installation safety factor: [*)]	[-]	1,2				

1) In absence of other national regulations

Table C3: Characteristic values to tension loads in precast, prestressed hollow core slabs C30/37 of design method A according to EN 1992-4

Characteristic values of resistance to tension loads of design method A			Performance		
			EUS7.5		
h_{nom}	Nominal embedment depth:	[mm]	35		
Tension loads: steel failure					
$N_{Rk,s}$	Tension steel characteristic resistance:	[kN]	18,7		
γ_{Ms}	Partial safety factor:[1)]	[-]	1,5		
Tension loads: pull-out failure in concrete					
$N_{Rk,p}$	Characteristic resistance in C20/25 uncracked concrete:	[kN]	3,5	4,0	4,5
Tension loads: concrete cone and splitting failure					
h_{hollow}	Minimum thickness of concrete member:	[mm]	25	30	35
$k_{ucr,N}$	Factor for uncracked concrete:	[-]	11,0		
$k_{cr,N}$	Factor for cracked concrete:	[-]	7,7		
$s_{cr,N}$	Critical spacing (concrete cone failure):	[mm]	3,0 x h_{ef}		
$c_{cr,N}$	Critical edge distance (concrete cone failure):	[mm]	1,5 x h_{ef}		
$s_{cr,sp}$	Critical spacing (splitting failure):	[mm]	87		
$c_{cr,sp}$	Critical edge distance (splitting failure):	[mm]	44		
γ_{inst}	Robustness:	[-]	1,2		

1) In absence of other national regulations

Table C4: Characteristic values to shear loads in precast, prestressed hollow core slabs C30/37 of design method A according to EN 1992-4

Characteristic values of resistance to shear loads of design method A			Performance
			EUS7.5
h_{nom}	Nominal embedment depth:	[mm]	35
Shear loads: steel failure without lever arm			
$V_{Rk,s}$	Characteristic resistance:	[kN]	10
k_7	Ductility factor:	[-]	0,8
γ_{Ms}	Partial safety factor: [1)]	[-]	1,25
Shear loads: steel failure with lever arm			
$M^0_{Rk,s}$	Characteristic bending moment:	[Nm]	15,2
γ_{Ms}	Partial safety factor: [*)]	[-]	1,25
Shear loads: concrete pry-out failure			
k_8	Pray-out factor:	[-]	1,0
γ_{inst}	Installation safety factor: [1)]	[-]	1,0
Shear loads: concrete edge failure			
l_f	Effective anchorage depth under shear loads:	[mm]	29
d_{nom}	Outside anchor diameter:	[mm]	6
γ_{inst}	Installation safety factor: [*)]	[-]	1,2

1) In absence of other national regulations

Table D1: Characteristic values to fire resistance

Fire resistance duration = 30 minutes			EUS7.5	EUS10.5	EUS12.5	EUS16.5
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			EUS7.5	EUS10.5	EUS12.5	EUS16.5
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			EUS7.5	EUS10.5	EUS12.5	EUS16.5
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			EUS7.5	EUS10.5	EUS12.5	EUS16.5
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			EUS7.5	EUS10.5	EUS12.5	EUS16.5
$S_{cr,N}$	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		EUS7.5	EUS10.5	EUS12.5	EUS16.5
k factor	[--]	1	1	1	2
According to 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.