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European Technical Assessment

ETA 22/0822 of 13/01/2023

(English language translation, the original version in Czech language)

Technical Assessment Body issuing the ETA: Technical and Test Institute for Construction Prague	
Trade name of the construction product	SCELLEMENT VINYLESTERE FIXH
Product family to which the construction product belongs	Product area code: 33 Bonded anchor for use in concrete
Manufacturer	SOGEDESCA 10 Rue General Plessier Lyon, 69002 France
Manufacturing plant(s)	Plant A
This European Technical Assessment contains	26 pages including 23 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	EAD 330499-01-0601 Bonded fasteners for use in concrete

1. Technical description of the product

The SCELLEMENT VINYLESTERE FIXH for cracked and uncracked concrete is a bonded anchor consisting of a cartridge with injection mortar and a steel element. The steel elements consists of a commercial threaded rods with a hexagon nut and a washer or reinforcing bar.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

The illustration and the description of the product are given in Annex A.

2. Specification of the intended use in accordance with the applicable EAD

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 provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the 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
Characteristic resistance to tension load (static and quasi-static loading)	Annex C 1, C 2, C 3, C 5
Characteristic resistance to shear load (static and quasi-static loading)	Annex C 1, C 4, C 6
Displacements under short term and long term loading	Annex C 7, C 8
Durability	Annex B 1
Characteristic resistance and displacements for seismic performance categories C1 and C2	Annex C 9, C 10, C 11

3.2 Hygiene, health and environment (BWR 3)

No performance determined.

3.3 General aspects relating to fitness for use

Durability and serviceability are only ensured if the specifications of intended use according to Annex B1 are kept.

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

According to the Decision 96/582/EC of the European Commission[1] the system of assessment verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) given in the following table applies.

Product	Intended use	Level or class	System
Metal anchors for use in concrete	For fixing and/or supporting to concrete, structural elements (which contributes to the stability of the construction works) or heavy units	-	1

[1] Official Journal of the European Communities L 254 of 08.10.1996

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

The factory production control shall be in accordance with the control plan which is a part of the technical documentation of this European Technical Assessment. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Technický a zkušební ústav stavební Praha, s.p.[2] The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

Issued in Prague on 13.01.2023

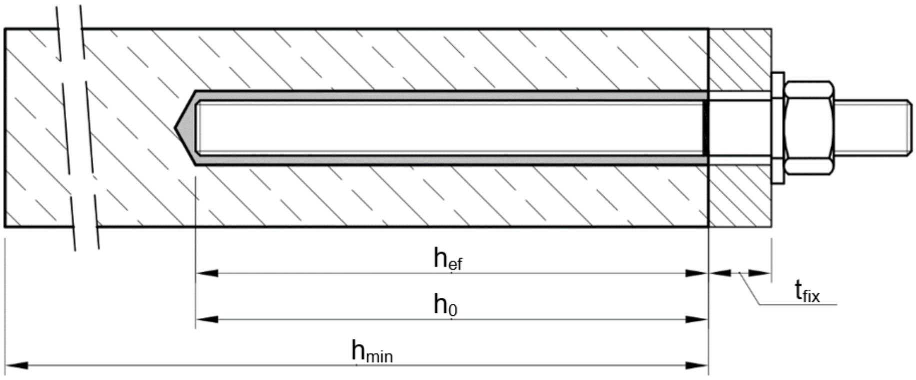
By

Ing. Jiří Studnička, Ph.D.
Head of the Technical Assessment Body

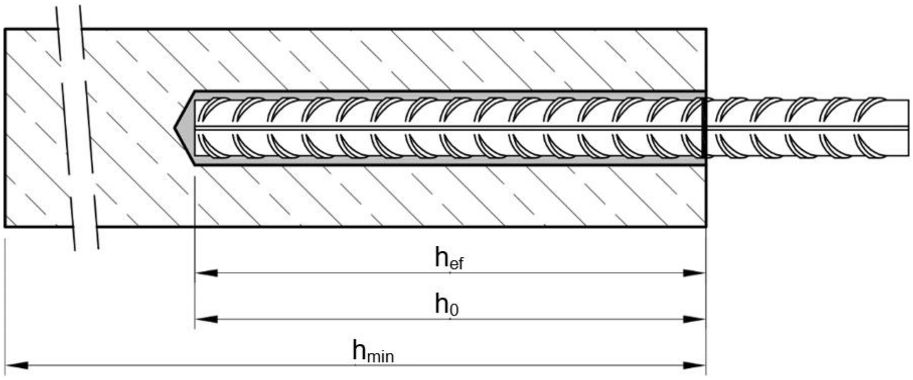
2 The control plan is a confidential part of the documentation of the European Technical Assessment, but not published together with the ETA and only handed over to the approved body involved in the procedure of AVCP.

Installation threaded rod M8 up to M24

prepositioned installation or
push through installation (annular gap filled with mortar)



Installation reinforcing bar Ø8 up to Ø25



t_{fix}	=	thickness of fixture	h_0	=	depth of drill hole
h_{ef}	=	effective embedment depth			
h_{min}	=	minimum thickness of member			

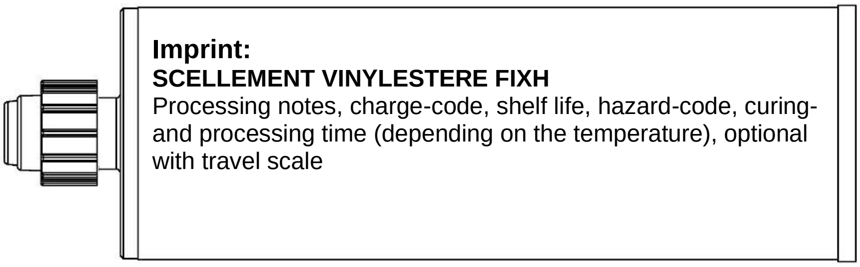
SCELLEMENT VINYLESTERE FIXH for concrete

Product description
Installed conditions

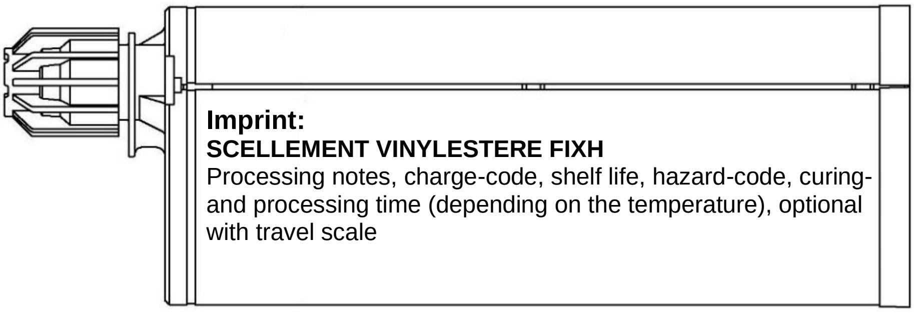
Annex A 1

Cartridge system

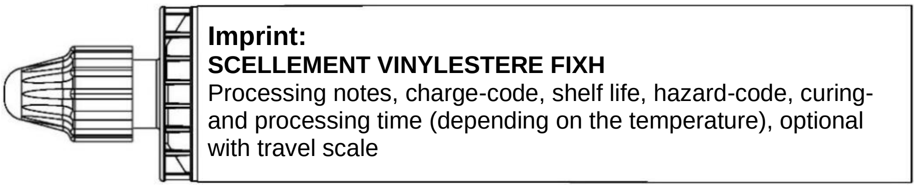
Coaxial Cartridge:
150 ml, 280 ml, 300 ml up to
333 ml and 380 ml up to 420 ml



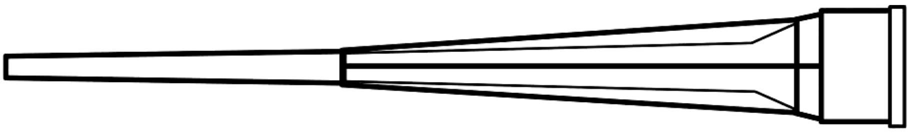
Side-by-Side Cartridge:
235 ml, 345 ml up to 360 ml
and 825 ml



Foil Tube Cartridge:
165 ml and 300 ml

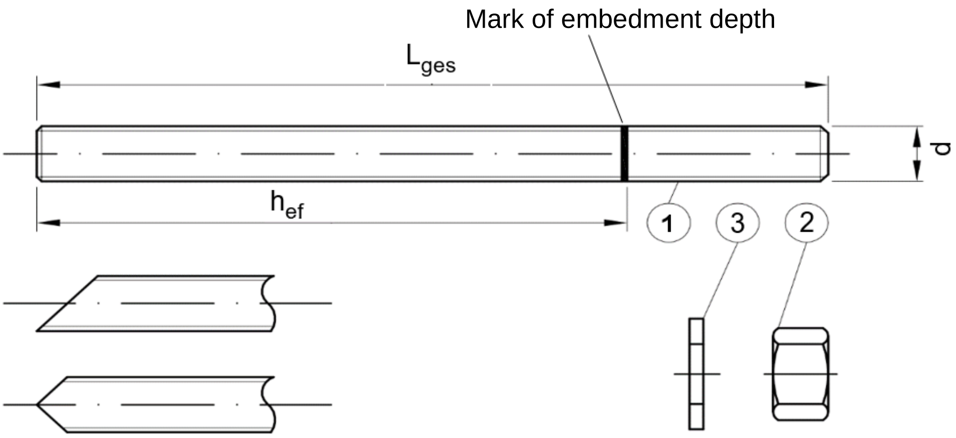


Static mixer M17



SCELLEMENT VINYLESTERE FIXH for concrete	**Annex A 2**
Product description Injection system	

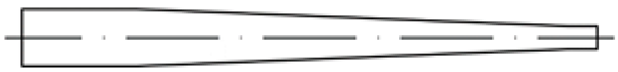
Threaded rod M8 up to M24 with washer and hexagon nut



Commercial standard threaded rod with:
- Materials, dimensions and mechanical properties acc. Table A1
- Inspection certificate 3.1 acc. to EN 10204:2004
- Marking of embedment depth

Filling washer KSW

Mixer reduction nozzle KSM



SCELLEMENT VINYLESTERE FIXH for concrete	**Annex A 3**
Product description Threaded rod, filling washer and mixer reduction nozzle	

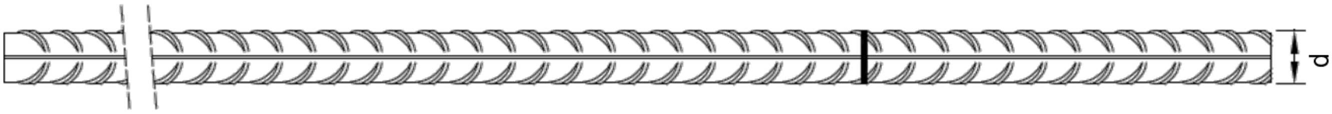
Table A1: Materials

Part	Designation	Material				
Steel, zinc plated (Steel acc. to EN ISO 683-4:2018 or EN 10263:2001) - zinc plated ≥ 5 µm acc. to EN ISO 4042:2018 or - hot-dip galvanized ≥ 40 µm acc. to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009 or - sherardized ≥ 45 µm acc. to EN ISO 17668:2016						
1	Anchor rod	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
		acc. to EN ISO 898-1:2013	4.6	f_{uk} = 400 N/mm²	f_{yk} = 240 N/mm²	A_5 > 8%
			4.8	f_{uk} = 400 N/mm²	f_{yk} = 320 N/mm²	A_5 > 8%
			5.6	f_{uk} = 500 N/mm²	f_{yk} = 300 N/mm²	A_5 > 8%
			5.8	f_{uk} = 500 N/mm²	f_{yk} = 400 N/mm²	A_5 > 8%
			8.8	f_{uk} = 800 N/mm²	f_{yk} = 640 N/mm²	A_5 > 12%[1)]
2	Hexagon nut	acc. to EN ISO 898-2:2012	4	for anchor rod class 4.6 or 4.8		
			5	for anchor rod class 5.6 or 5.8		
			8	for anchor rod class 8.8		
3a	Washer	Steel, zinc plated, hot-dip galvanized or sherardized (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)				
3b	Filling washer	Steel, zinc plated, hot-dip galvanized or sherardized				
Stainless steel A2 (Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014) **Stainless steel A4** (Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014) **High corrosion resistance steel** (Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014)						
1	Anchor rod[2)]	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
		acc. to EN ISO 3506-1:2009	50	f_{uk} = 500 N/mm²	f_{yk} = 210 N/mm²	A_5 > 8%
			70	f_{uk} = 700 N/mm²	f_{yk} = 450 N/mm²	A_5 > 12%[1)]
			80	f_{uk} = 800 N/mm²	f_{yk} = 600 N/mm²	A_5 > 12%[1)]
2	Hexagon nut[2)]	acc. to EN ISO 3506-1:2009	50	for anchor rod class 50		
			70	for anchor rod class 70		
			80	for anchor rod class 80		
3a	Washer	A2: Material 1.4301, 1.4311 / 1.4307 / 1.4567 or 1.4541, EN 10088-1:2014 A4: Material 1.4401, 1.4404 / 1.4571 / 1.4362 or 1.4578, EN 10088-1:2014 HCR: Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014 (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)				
3b	Filling washer	Stainless steel A4, High corrosion resistance steel				

1) A_5 > 8% fracture elongation if no use for seismic performance category C2

2) Property class 80 only for stainless steel A4 and high corrosion resistant steel HCR

Reinforcing bar: ø8 up to ø25



- Minimum value of related rib area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar shall be in the range 0,05 ϕ ≤ h_{rib} ≤ 0,07 ϕ
  (d: nominal diameter of the bar; h_{rib}: Rib height of the bar)

Table A2: Materials Reinforcing bar

Part	Designation	Material
Rebar		
3	Reinforcing steel according to EN 1992-1-1:2004+AC:2018, Annex C	Bars and rebars from ring class B or C f_{yk} and k according to NDP or NCL according to EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$

SCELLEMENT VINYLESTERE FIXH for concrete	
Product description Materials reinforcing bar	**Annex A 5**

Specifications of the intended use

Fasteners subject to (Static and quasi-static loads):

	Working life 50 years		Working life 100 years	
Base material	uncracked concrete	cracked concrete	uncracked concrete	cracked concrete
HD: Hammer drilling CD: Compressed air drilling	M8 to M24 Ø 8 to Ø 25	M8 to M16	No performance assessed	No performance assessed
Temperature Range:	I: -40°C to +40°C[1)] II: -40°C to +80°C[2)]		I: -40°C to +40°C[1)] II: -40°C to +80°C[2)]	

Fasteners subject to (seismic action):

	Performance Category C1	Performance Category C2
Base material	uncracked and cracked concrete	uncracked and cracked concrete
HD: Hammer drilling CD: Compressed air drilling	M8 to M16	M12 to M16
Temperature Range:	I: -40°C to +40°C[1)] II: -40°C to +80°C[2)]	I: -40°C to +40°C[1)] II: -40°C to +80°C[2)]

1) (max. long-term temperature +24°C and max. short-term temperature +40°C)
2) (max. long-term temperature +50°C and max. short-term temperature +80°C)

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance class:
  - Stainless steel A2 according to Annex A 4, Table A1: CRC II
  - Stainless steel A4 according to Annex A 4, Table A1: CRC III
  - High corrosion resistance steel HCR according to Annex A 4, Table A1: CRC V

Design:

- Verifiable calculation notes and drawings are prepared taking 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.).
- Fasteners are designed under the responsibility of an engineer experienced in fasteners and concrete work.
- The fasteners are designed in accordance to EN 1992-4:2018 and Technical Report TR 055, Edition February 2018.

Installation:

- Dry, wet concrete or flooded bore holes (not sea-water).
- Hole drilling by hammer drill (HD) or compressed air drill mode (CD).
- Overhead installation allowed.
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

SCELLEMENT VINYLESTERE FIXH for concrete	**Annex B 1**
Intended use Specifications	

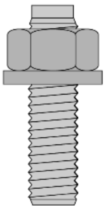
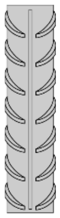
Table B1: Installation parameters for threaded rod

Anchor size				M8	M10	M12	M16	M20	M24
Diameter of element		$d = d_{nom}$	[mm]	8	10	12	16	20	24
Nominal drill hole diameter		d_0	[mm]	10	12	14	18	24	28
Effective embedment depth		$h_{ef,min}$	[mm]	60	60	70	80	90	96
		$h_{ef,max}$	[mm]	160	200	240	320	400	480
Diameter of clearance hole in the fixture	Prepositioned installation	$d_f \leq$	[mm]	9	12	14	18	22	26
	Push through installation	d_f	[mm]	12	14	16	20	24	30
Maximum torque moment		max $T_{inst} \leq$	[Nm]	10	20	40	80	120	160
Minimum thickness of member		h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm			$h_{ef} + 2d_0$		
Minimum spacing		s_{min}	[mm]	40	50	60	80	100	120
Minimum edge distance		c_{min}	[mm]	40	50	60	80	100	120

Table B2: Installation parameters for rebar

Anchor size			∅ 8	∅ 10	∅ 12	∅ 14	∅ 16	∅ 20	∅ 25
Diameter of element	$d = d_{nom}$	[mm]	8	10	12	14	16	20	25
Nominal drill hole diameter	d_0	[mm]	12	14	16	18	20	25	32
Effective embedment depth	$h_{ef,min}$	[mm]	60	60	70	75	80	90	100
	$h_{ef,max}$	[mm]	160	200	240	280	320	400	500
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm		$h_{ef} + 2d_0$				
Minimum spacing	s_{min}	[mm]	40	50	60	70	80	100	130
Minimum edge distance	c_{min}	[mm]	40	50	60	70	80	100	130

Table B3: Parameter cleaning and installation tools

					
Threaded rod	**Reinforcing bar**	**d_0 Drill bit - ∅ HD, HDB, CD**	**d_b Brush - ∅**		**$d_{b,min}$ min. Brush - ∅**
[mm]	[mm]	[mm]		[mm]	[mm]
M8	-	10	SC10	12	10,5
M10	8	12	SC12	14	12,5
M12	10	14	SC14	16	14,5
-	12	16	SC16	18	16,5
M16	14	18	SC18	20	18,5
-	16	20	SC20	22	20,5
M20	-	24	SC24	26	24,5
-	20	25	SC25	27	25,5
M24	-	28	SC28	30	28,5
-	25	32	SC32	34	32,5

Cleaning and installation tools

Hand pump
(Volume 750 ml, $h_0 \geq 10\ d_{nom}$, $d_0 \leq 20$mm)

Compressed air tool
(min 6 bar)

Brush SC

Brush extension SL

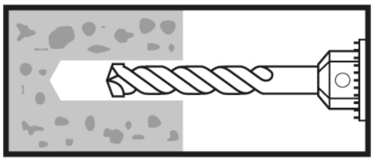
SCELLEMENT VINYLESTERE FIXH for concrete	**Annex B 3**
Intended use IParameter anchor and drill sizes, brushes and piston plugs Cleaning and Installation tools	

Table B4: Working and curing time

Temperature in base material			Maximum working time	Minimum curing time
T			t_{work}	t_{cure}
- 5 °C	to	- 1 °C	90 min	6 h
+ 0 °C	to	+ 4 °C	45 min	3 h
+ 5 °C	to	+ 9 °C	25 min	2 h
+ 10 °C	to	+ 14 °C	20 min	100 min
+ 15 °C	to	+ 19 °C	15 min	80 min
+ 20 °C	to	+ 29 °C	6 min	45 min
+ 30 °C	to	+ 34 °C	4 min	25 min
+ 35 °C	to	+ 39 °C	2 min	20 min
Cartridge temperature			+5°C up to +40°C	

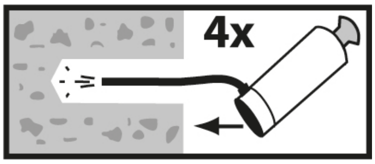
Installation instructions

Drilling of the bore hole



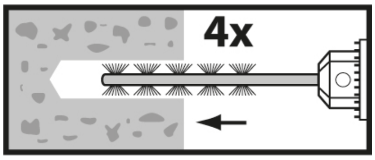
1. **Hammer drilling (HD) / Compressed air drilling (CD)**
Drill a hole to the required embedment depth.
Drill bit diameter according to Table B1 and B2.
Aborted drill holes shall be filled with mortar.
Proceed with Step 2 (MAC or CAC).

Manual Air Cleaning (MAC)
for drill hole diameter $d_0 \leq 20mm$ and drill hole depth $h_0 \leq 10d_{nom}$ with drilling method HD/CD

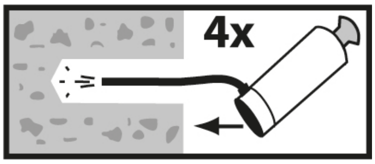


Attention! Remove standing water in the borehole before cleaning.

2a. Blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 3).

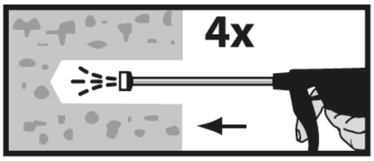


2b. Attach brush SC according to Table B3 to a drilling machine or a cordless screwdriver. Brush the bore hole minimum 4x over the entire embedment depth in a twisting motion (if necessary, use a brush extension SL).



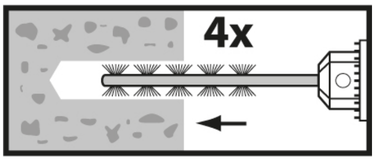
2c. Finally blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 3).

Compressed Air Cleaning (CAC):
All diameter with drilling method HD/CD



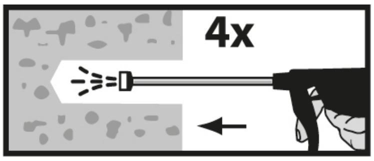
Attention! Standing water in the bore hole must be removed before cleaning.

2a. Blow the bore hole clean minimum 4x with compressed air (min. 6 bar) (Annex B 3) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)



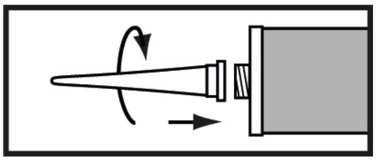
2b. Attach brush SC according to Table B3 to a drilling machine or a cordless screwdriver. Brush the bore hole minimum 4x over the entire embedment depth in a twisting motion. (If necessary, a brush extension SL shall be used.)

Installation instructions (continuation)

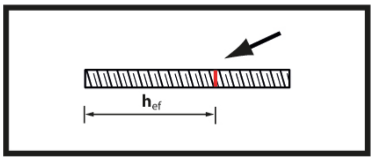


2c. Finally blow the bore hole clean minimum 4x with compressed air (min. 6 bar) (Annex B 3) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

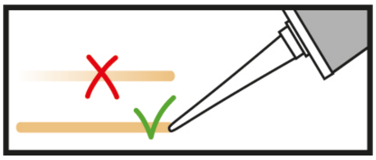
Cleaned bore hole has to be protected against re-contamination in an appropriate way.
If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.



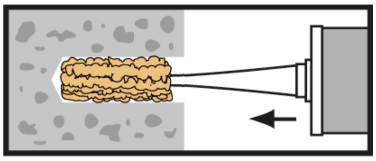
3. Screw on static-mixing nozzle M17 and load the cartridge into an appropriate dispensing tool.
If necessary, cut off the foil tube clip before use.
For every working interruption longer than the maximum working time t_{work} (Annex B 4) as well as for new cartridges, a new static-mixer shall be used.



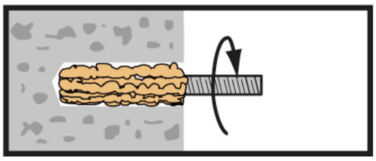
4. Mark embedment depth on the anchor rod.
The anchor rod shall be free of dirt, grease, oil or other foreign material.



5. Not proper mixed mortar is not sufficient for fastening.
Dispense and discard mortar until an uniform grey colour is shown (at least 3 full strokes; for foil tube cartridges min. 6 strokes).



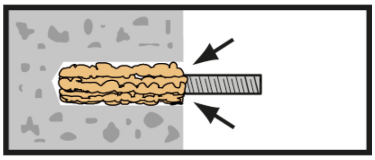
6. Starting at bottom of the hole and fill the hole up to approximately 2/3 with adhesive (If necessary, a mixer nozzle extension shall be used.)
Slowly withdraw of the static mixing nozzle avoid creating air pockets
Observe the temperature related working time t_{work} (Annex B 4).



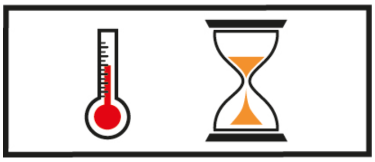
7. Insert the anchor rod while turning slightly up to the embedment mark.

SCELLEMENT VINYLESTERE FIXH for concrete	**Annex B 6**
Intended use Installation instructions (continuation)	

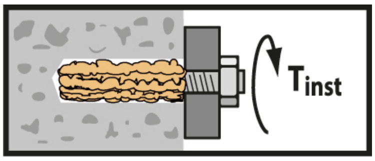
Installation instructions (continuation)



8. Annular gap between anchor rod and base material must be completely filled with mortar. In case of push through installation the annular gap in the fixture must be filled with mortar also.
Otherwise, the installation must be repeated starting from step 6 before the maximum working time t_{work} has expired.



9. Temperature related curing time t_{cure} (Annex B 4) must be observed.
Do not move or load the fastener during curing time.



10. Install the fixture by using a calibrated torque wrench. Observe maximum installation torque (Table B1).
In case of static requirements (e.g. seismic), fill the annular gap in the fixture with mortar (Annex A 2).
Therefore, replace the washer by the filling washer KSW and use the mixer reduction nozzle KSM.

Table C1: Characteristic values for steel tension resistance and steel shear resistance of threaded rods

Size				M8	M10	M12	M16	M20	M24
Cross section area		A_s	[mm²]	36,6	58	84,3	157	245	353
Characteristic tension resistance, Steel failure [1)]									
Steel, Property class 4.6 and 4.8		$N_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141
Steel, Property class 5.6 and 5.8		$N_{Rk,s}$	[kN]	18 (17)	29 (27)	42	78	122	176
Steel, Property class 8.8		$N_{Rk,s}$	[kN]	29 (27)	46 (43)	67	125	196	282
Stainless steel A2, A4 and HCR, class 50		$N_{Rk,s}$	[kN]	18	29	42	79	123	177
Stainless steel A2, A4 and HCR, class 70		$N_{Rk,s}$	[kN]	26	41	59	110	171	247
Stainless steel A4 and HCR, class 80		$N_{Rk,s}$	[kN]	29	46	67	126	196	282
Characteristic tension resistance, Partial safety factor [2)]									
Steel, Property class 4.6 and 5.6		$\gamma_{Ms,N}$	[-]	2,0					
Steel, Property class 4.8, 5.8 and 8.8		$\gamma_{Ms,N}$	[-]	1,5					
Stainless steel A2, A4 and HCR, class 50		$\gamma_{Ms,N}$	[-]	2,86					
Stainless steel A2, A4 and HCR, class 70		$\gamma_{Ms,N}$	[-]	1,87					
Stainless steel A4 and HCR, class 80		$\gamma_{Ms,N}$	[-]	1,6					
Characteristic shear resistance, Steel failure [1)]									
Without lever arm	Steel, Property class 4.6 and 4.8	$V^0_{Rk,s}$	[kN]	9 (8)	14 (13)	20	38	59	85
Without lever arm	Steel, Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	9 (8)	15 (13)	21	39	61	88
Without lever arm	Steel, Property class 8.8	$V^0_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141
Without lever arm	Stainless steel A2, A4 and HCR, class 50	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88
Without lever arm	Stainless steel A2, A4 and HCR, class 70	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124
Without lever arm	Stainless steel A4 and HCR, class 80	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141
With lever arm	Steel, Property class 4.6 and 4.8	$M^0_{Rk,s}$	[Nm]	15 (13)	30 (27)	52	133	260	449
With lever arm	Steel, Property class 5.6 and 5.8	$M^0_{Rk,s}$	[Nm]	19 (16)	37 (33)	65	166	324	560
With lever arm	Steel, Property class 8.8	$M^0_{Rk,s}$	[Nm]	30 (26)	60 (53)	105	266	519	896
With lever arm	Stainless steel A2, A4 and HCR, class 50	$M^0_{Rk,s}$	[Nm]	19	37	66	167	325	561
With lever arm	Stainless steel A2, A4 and HCR, class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	232	454	784
With lever arm	Stainless steel A4 and HCR, class 80	$M^0_{Rk,s}$	[Nm]	30	59	105	266	519	896
Characteristic shear resistance, Partial safety factor [2)]									
Steel, Property class 4.6 and 5.6		$\gamma_{Ms,V}$	[-]	1,67					
Steel, Property class 4.8, 5.8 and 8.8		$\gamma_{Ms,V}$	[-]	1,25					
Stainless steel A2, A4 and HCR, class 50 50		$\gamma_{Ms,V}$	[-]	2,38					
Stainless steel A2, A4 and HCR, class 50 70		$\gamma_{Ms,V}$	[-]	1,56					
Stainless steel A4 and HCR, class 80		$\gamma_{Ms,V}$	[-]	1,33					

1) Values are only valid for the given stress area A_s. Values in brackets are valid for undersized threaded rods with smaller stress area A_s for hot-dip galvanised threaded rods according to EN ISO 10684:2004+AC:2009.
2) In absence of national regulation

SCELLEMENT VINYLESTERE FIXH for concrete

Performances
Characteristic values for steel tension resistance and steel shear resistance of threaded rods

Annex C 1

Table C2: Characteristic values of tension loads under static and quasi-static action

Anchor size				All anchors types and sizes
Concrete cone failure				
Uncracked concrete		$k_{ucr,N}$	[-]	11,0
Cracked concrete		$k_{cr,N}$	[-]	7,7
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}
Axial distance		$s_{cr,N}$	[mm]	2 $c_{cr,N}$
Splitting				
Edge distance	$h/h_{ef} \geq 2,0$	$c_{cr,sp}$	[mm]	1,0 h_{ef}
	$2,0 > h/h_{ef} > 1,3$			$2 \cdot h_{ef} \left(2,5 - \frac{h}{h_{ef}} \right)$
	$h/h_{ef} \leq 1,3$			2,4 h_{ef}
Axial distance		$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$

SCELLEMENT VINYLESTERE FIXH for concrete	**Annex C 2**
Performances Characteristic values of tension loads under static and quasi-static action	

Table C3: Characteristic values of tension loads under static and quasi-static action

Anchor size threaded rod						M8	M10	M12	M16	M20	M24
Steel failure											
Characteristic tension resistance			$N_{Rk,s}$	[kN]		$A_s \cdot f_{uk}$ (or see Table C1)					
Partial factor			$\gamma_{Ms,N}$	[-]		See Table C1					
Combined pull-out and concrete failure											
Characteristic bond resistance in uncracked concrete C20/25											
Temperature range	I:	40°C/24°C	Dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	8,5	8,0	8,0	8,0	8,0	8,0
Temperature range	II:	80°C/50°C	Dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,0	6,0	6,0	6,0	6,0
Temperature range	I:	40°C/24°C	Flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	8,5	8,0	8,0	8,0	8,0	8,0
Temperature range	II:	80°C/50°C	Flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,0	6,0	6,0	6,0	6,0
Characteristic bond resistance in cracked concrete C20/25											
Temperature range	I:	40°C/24°C	Dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	4,5	4,5	No performance assessed	
Temperature range	II:	80°C/50°C	Dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	3,5	3,5		
Temperature range	I:	40°C/24°C	Flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	4,5	4,5		
Temperature range	II:	80°C/50°C	Flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	3,5	3,5		
Increasing factor for uncracked concrete			ψ_c	[-]		$(f_{ck} / 20)^{0,2}$					
Increasing factor for cracked concrete			ψ_c	[-]		$(f_{ck} / 20)^{0,1}$					
Characteristic bond resistance depending on the concrete strength class			$\tau_{Rk,ucr} =$			$\psi_c \cdot \tau_{Rk,ucr,(C20/25)}$					
			$\tau_{Rk,cr} =$			$\psi_c \cdot \tau_{Rk,cr,(C20/25)}$					
Concrete cone failure											
Relevant parameter						See Table C2					
Splitting											
Relevant parameter						See Table C2					
Installation factor											
Dry and wet concrete			γ_{inst}	[-]		1,2					
Flooded bore hole			γ_{inst}	[-]		1,2					

Table C4: Characteristic values of shear loads under static and quasi-static action								
Anchor size threaded rod			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure without lever arm								
Characteristic shear resistance Steel, strength class 4.6, 4.8 and 5.6, 5.8	$V^0_{Rk,s}$	[kN]	$0,6 \cdot A_s \cdot f_{uk}$ (or see Table C1)					
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classes	$V^0_{Rk,s}$	[kN]	$0,5 \cdot A_s \cdot f_{uk}$ (or see Table C1)					
Partial factor	$\gamma_{Ms,V}$	[-]	See Table C1					
Ductility factor	k_7	[-]	1,0					
Steel failure with lever arm								
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1,2 \cdot W_{el} \cdot f_{uk}$ (or see Table C1)					
Elastic section modulus	W_{el}	[mm³]	31	62	109	277	541	935
Partial factor	$\gamma_{Ms,V}$	[-]	See Table C1					
Concrete pry-out failure								
Factor	k_8	[-]	2,0					
Installation factor	γ_{inst}	[-]	1,0					
Concrete edge failure								
Effective length of fastener	l_f	[mm]	$\min(h_{ef}; 12 \cdot d_{nom})$					
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	16	20	24
Installation factor	γ_{inst}	[-]	1,0					

Table C5: Characteristic values of tension loads under static and quasi-static action

<table>
<tr><th colspan="5">Anchor size reinforcing bar</th><th>Ø 8</th><th>Ø 10</th><th>Ø 12</th><th>Ø 14</th><th>Ø 16</th><th>Ø 20</th><th>Ø 25</th></tr>
<tr><td colspan="12">Steel failure</td></tr>
<tr><td colspan="3">Characteristic tension resistance</td><td>$N_{Rk,s}$</td><td>[kN]</td><td colspan="7">$A_s \cdot f_{uk}$ [1)]</td></tr>
<tr><td colspan="3">Cross section area</td><td>A_s</td><td>[mm²]</td><td>50</td><td>79</td><td>113</td><td>154</td><td>201</td><td>314</td><td>491</td></tr>
<tr><td colspan="3">Partial factor</td><td>$\gamma_{Ms,N}$</td><td>[-]</td><td colspan="7">1,4 [2)]</td></tr>
<tr><td colspan="12">Combined pull-out and concrete failure</td></tr>
<tr><td colspan="12">Characteristic bond resistance in uncracked concrete C20/25</td></tr>
<tr><td rowspan="4">Temperature range</td><td>I: 40°C/24°C</td><td rowspan="2">Dry and wet concrete</td><td rowspan="4">$\tau_{Rk,ucr}$</td><td rowspan="4">[N/mm²]</td><td>7,0</td><td>7,0</td><td>7,0</td><td>7,0</td><td>6,5</td><td>6,5</td><td>6,5</td></tr>
<tr><td>II: 80°C/50°C</td><td>5,5</td><td>5,5</td><td>5,5</td><td>5,5</td><td>5,5</td><td>5,0</td><td>5,0</td></tr>
<tr><td>I: 40°C/24°C</td><td rowspan="2">Flooded bore hole</td><td>7,0</td><td>7,0</td><td>7,0</td><td>7,0</td><td>6,5</td><td>6,5</td><td>6,5</td></tr>
<tr><td>II: 80°C/50°C</td><td>5,5</td><td>5,5</td><td>5,5</td><td>5,5</td><td>5,5</td><td>5,0</td><td>5,0</td></tr>
<tr><td colspan="3">Increasing factor for uncracked concrete</td><td>ψ_c</td><td>[-]</td><td colspan="7">$(f_{ck} / 20)^{0,1}$</td></tr>
<tr><td colspan="3">Characteristic bond resistance depending on the concrete strength class</td><td colspan="2">$\tau_{Rk,ucr}$ =</td><td colspan="7">$\psi_c \cdot \tau_{Rk,ucr,(C20/25)}$</td></tr>
<tr><td colspan="12">Concrete cone failure</td></tr>
<tr><td colspan="5">Relevant parameter</td><td colspan="7">See Table C2</td></tr>
<tr><td colspan="12">Splitting</td></tr>
<tr><td colspan="5">Relevant parameter</td><td colspan="7">See Table C2</td></tr>
<tr><td colspan="12">Installation factor</td></tr>
<tr><td colspan="3">Dry and wet concrete</td><td rowspan="2">γ_{inst}</td><td rowspan="2">[-]</td><td colspan="7">1,2</td></tr>
<tr><td colspan="3">Flooded bore hole</td><td colspan="7">1,2</td></tr>
</table>

1) f_{uk} shall be taken from the specifications of reinforcing bars
2) in absence of national regulation

Table C6: Characteristic values of shear loads under static and quasi-static action

Anchor size reinforcing bar			**∅ 8**	**∅ 10**	**∅ 12**	**∅ 14**	**∅ 16**	**∅ 20**	**∅ 25**
Steel failure without lever arm									
Characteristic shear resistance	$V^0_{Rk,s}$	[kN]	$0{,}50 \cdot A_s \cdot f_{uk}$ [1)]						
Cross section area	A_s	[mm²]	50	79	113	154	201	314	491
Partial factor	$\gamma_{Ms,V}$	[-]	1,5 [2)]						
Ductility factor	k_7	[-]	1,0						
Steel failure with lever arm									
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1{,}2 \cdot W_{el} \cdot f_{uk}$ [1)]						
Elastic section modulus	W_{el}	[mm³]	50	98	170	269	402	785	1534
Partial factor	$\gamma_{Ms,V}$	[-]	1,5 [2)]						
Concrete pry-out failure									
Factor	k_8	[-]	2,0						
Installation factor	γ_{inst}	[-]	1,0						
Concrete edge failure									
Effective length of fastener	l_f	[mm]	min (h_{ef}; $12 \cdot d_{nom}$)						min (h_{ef}; 300mm)
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	14	16	20	25
Installation factor	γ_{inst}	[-]	1,0						

1) f_{uk} shall be taken from the specifications of reinforcing bars
2) in absence of national regulation

SCELLEMENT VINYLESTERE FIXH for concrete

Performances
Characteristic values of shear loads under static and quasi-static action

Annex C 6

Table C7: Displacement under tension load[1)]

Anchor size threaded rod			M8	M10	M12	M16	M20	M24
Uncracked concrete C20/25 under static and quasi-static action								
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,03	0,04	0,05	0,07	0,08	0,10
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,07	0,08	0,08	0,08	0,08	0,10
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,02	0,03	0,03	0,04	0,04	0,05
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,15	0,17	0,17	0,17	0,17	0,17
Cracked concrete C20/25 under static and quasi-static action								
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,07	0,08	0,07	0,08	No performance assessed	
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,13	0,11	0,11	0,10		
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,09	0,08	0,07	0,09		
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,17	0,14	0,14	0,13		

1) Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; τ: action bond stress for tension
$\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$;

Table C8: Displacement under shear load[1)]

Anchor size threaded rod			M8	M10	M12	M16	M20	M24
Uncracked concrete C20/25 under static and quasi-static action								
All temperature ranges	δ_{V0}-factor	[mm/kN]	0,02	0,02	0,01	0,01	0,01	0,01
	$\delta_{V\infty}$-factor	[mm/kN]	0,03	0,02	0,02	0,01	0,01	0,01
Cracked concrete C20/25 under static and quasi-static action								
All temperature ranges	δ_{V0}-factor	[mm/kN]	0,05	0,04	0,03	0,01	No performance assessed	
	$\delta_{V\infty}$-factor	[mm/kN]	0,07	0,06	0,04	0,02		

1) Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; V: action shear load
$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;

Table C9: Displacement under tension load[1)]

Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25
Uncracked concrete C20/25 under static and quasi-static action									
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,03	0,06	0,02	0,03	0,05	0,06	0,06
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,08	0,08	0,08	0,08	0,08	0,08	0,08
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,03	0,06	0,02	0,03	0,05	0,06	0,06
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,15	0,15	0,15	0,15	0,16	0,16	0,16

1) Calculation of the displacement
$\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$; τ: action bond stress for tension
$\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$;

Table C10: Displacement under shear load[1)]

Anchor size reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25
Uncracked concrete C20/25 under static and quasi-static action									
All temperature ranges	δ_{V0}-factor	[mm/kN]	0,04	0,04	0,01	0,01	0,01	0,01	0,01
	$\delta_{V\infty}$-factor	[mm/kN]	0,05	0,06	0,02	0,02	0,02	0,02	0,02

1) Calculation of the displacement
$\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$; V: action shear load
$\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$;

Table C11: Characteristic values of tension loads under seismic action (Performance category C1)

Anchor size threaded rod					M8	M10	M12	M16
Steel failure								
Characteristic tension resistance			$N_{Rk,s,C1}$	[kN]	$1{,}0 \cdot N_{Rk,s}$			
Partial factor			$\gamma_{Ms,N}$	[-]	See Table C1			
Combined pull-out and concrete failure								
Characteristic bond resistance in cracked and uncracked concrete C20/25								
Temperature range	I: 40°C/24°C	Dry and wet concrete	$\tau_{Rk,C1}$	[N/mm²]	2,30	2,25	2,30	2,20
	II: 80°C/50°C				1,85	1,80	1,80	1,75
	I: 40°C/24°C	Flooded bore hole			2,30	2,25	2,30	2,20
	II: 80°C/50°C				1,85	1,80	1,80	1,75
Increasing factor for concrete			ψ_c	[-]	1,0			
Characteristic bond resistance depending on the concrete strength class			$\tau_{Rk,C1} =$		$\psi_c \cdot \tau_{Rk,C1,(C20/25)}$			
Installation factor								
Dry and wet concrete			γ_{inst}	[-]	1,2			
Flooded bore hole					1,2			

Table C12: Characteristic values of tension loads under seismic action (Performance category C2)

Anchor size threaded rod					M12	M16
Steel failure						
Characteristic tension resistance Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70			$N_{Rk,s,C2}$	[kN]	$1{,}0 \cdot N_{Rk,s}$	
Partial factor			$\gamma_{Ms,N}$	[-]	See Table C1	
Combined pull-out and concrete failure						
Characteristic bond resistance in cracked and uncracked concrete C20/25						
Temperature range	I: 40°C/24°C	Dry and wet concrete	$\tau_{Rk,C2}$	[N/mm²]	0,75	0,95
	II: 80°C/50°C				0,60	0,75
	I: 40°C/24°C	Flooded bore hole			0,75	0,95
	II: 80°C/50°C				0,60	0,75
Increasing factor for concrete			ψ_c	[-]	1,0	
Characteristic bond resistance depending on the concrete strength class			$\tau_{Rk,C2} =$		$\psi_c \cdot \tau_{Rk,C2,(C20/25)}$	
Installation factor						
Dry and wet concrete			γ_{inst}	[-]	1,2	
Flooded bore hole					1,2	

Table C13: Characteristic values of shear loads under seismic action (Performance category C1 and C2)

Anchor size threaded rod			M8	M10	M12	M16
Steel failure without lever arm						
Characteristic shear resistance (Seismic C1)	$V_{Rk,s,C1}$	[kN]	$0,7 \cdot V^0_{Rk,s}$			
Characteristic shear resistance (Seismic C2) Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, Strength class ≥70	$V_{Rk,s,C2}$	[kN]	No performance assessed		$0,7 \cdot V^0_{Rk,s}$	
Partial factor	$\gamma_{Ms,V}$	[-]	See Table C1			
Factor for annular gap	α_{gap}	[-]	0,5 (1,0)[1)]			

1) Value in brackets valid for filled annular gap between anchor and clearance hole in the fixture. Use of special filling washer Annex A 3 is recommended

SCELLEMENT VINYLESTERE FIXH for concrete

Performances
Characteristic values of shear loads under seismic action
(Performance category C1 and C2)

Annex C 10

Table C14: Displacement under tension load

Anchor size threaded rod			M8	M10	M12	M16
Uncracked and cracked concrete under seismic action (performance category C2)						
Temperature range I: 40°C/24°C	$\delta_{N,C2(DLS)}$	[mm]	No performance assessed		0,23	0,29
	$\delta_{N,C2(ULS)}$	[mm]			0,43	0,55
Temperature range II: 80°C/50°C	$\delta_{N,C2(DLS)}$	[mm]			0,23	0,29
	$\delta_{N,C2(ULS)}$	[mm]			0,43	0,55

Table C15: Displacement under shear load

Anchor size threaded rod			M8	M10	M12	M16
Uncracked and cracked concrete under seismic action (performance category C2)						
Temperature range I: 40°C/24°C	$\delta_{V,C2(DLS)}$	[mm]	No performance assessed		3,6	3,0
	$\delta_{V,C2(ULS)}$	[mm]			7,0	6,6
Temperature range II: 80°C/50°C	$\delta_{V,C2(DLS)}$	[mm]			3,6	3,0
	$\delta_{V,C2(ULS)}$	[mm]			7,0	6,6