DECLARATION OF PERFORMANCE

DoP Nr.: **Sikla-1.3-101**_en

Unique identification code of product-type:	**Screwbolt TSM**
Intended use/es:	Mechanical fastener for use in concrete, see Annex B
Manufacturer:	Sikla Holding GmbH Kornstraße 4 4614 Marchtrenk - Österreich
System/s of AVCP:	1
European Assessment Document:	**EAD 330232-01-0601**
European Technical Assessment:	**ETA-16/0655, 02.12.2021**
Technical Assessment Body:	DIBt, Berlin
Notified body/ies:	NB 2873 – Technische Universität Darmstadt

Declared performance/s:

Essential characteristics	Performance
Mechanical resistance and stability (BWR 1)	
Characteristic resistance to tension load (static and quasi-static loading) Method A	Annex B2, C1
Characteristic resistance to shear load (static and quasi-static loading)	Annex C1
Displacements	Annex C6
Durability	Annex B1
Characteristic resistance and displacements for seismic performance category C1 and C2	Annex C2-C4. C7
Safety in case of fire (BWR 2)	
Reaction to fire	Class A1
Resistance to fire	Annex C5

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 identified above.

Signed for and on behalf of the manufacturer by:

Günter Brugger
(Head of IPRM)

Achim Münch
(Head of Management Systems)

Villingen-Schwenningen 12.10.2022

The original of this declaration of performance was written in German. In the event of deviations in the translation, the German version shall be valid.

Specifications of Intended use

Screwbolt TSM		TSM 6		TSM 8			TSM 10			TSM 12			TSM 14		
Nominal embedment depth h_{nom} [mm]		40	55	45	55	65	55	75	85	65	85	100	75	100	115
Anchorages subject to	Static or quasi-static loading	✓													
	Fire exposure	✓													
	Seismic action C1 (zinc plated, A4, HCR)	Tension load: BI, B, SU…TX, SU, S, SK, LK, LP, BSK, ST, IM Shear load: BI, B, SU…TX, SU, S, SK, LK, LP													
		✓		1)		✓	✓	1)	✓	1)		✓	1)		✓
	Seismic action C2 (zinc plated)	Tension load and shear load: with filled annular gap: BI, B, SU…TX, SU, S, LK, LP without filled annular gap: BI, B, SU…TX, SU, S, SK [2], LK, LP													
		1)		1)		✓	1)	1)	✓	1)		✓	1)		✓
Base material	Cracked or uncracked concrete	✓													
	Reinforced or unreinforced concrete (without fibres) acc. to EN 206:2013+A1:2016	✓													
	Strength classes according to EN 206:2013+A1:2016, C20/25 to C50/60	✓													

1) no performance assessed

2) Version SK, TSM 8 and TSM 10

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions: all materials
- For all other conditions corresponding to corrosion resistance classes CRC according to EN 1993-1-4:2006 +A1:2015:
  - stainless steel A4, according to Annex A3, Table A3: CRC III
  - high corrosion resistant steel HCR, according to Annex A3, Table A3: CRC V

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.)
- Design method of anchorages according to EN 1992-4:2018 (if necessary in conection with EOTA Technical Report TR 055, version February 2018)

Installation:

- Making of drill hole by hammer drilling or vacuum drill bit.
  When using a vacuum drill bit no drill hole cleaning is required.
- Anchor installation carried out by appropriately qualified personal and under the responsibility of the person responsible for technical matters on site.
- After installation further turning of the anchor is not possible. The head of the anchor is supported on the fixture and is not damaged.
- The borehole may be filled with the Injection Systems VME or VME plus.
- Adjustment according to Annex B5 (except for anchorages with filled borehole and anchorages subject to seismic action).

Table B1: Installation parameters

Anchor size			TSM 6		TSM 8			TSM 10			TSM 12			TSM 14		
Nominal embedment depth	h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Nominal drill bit diameter	d_0	[mm]	6		8			10			12			14		
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	6,40		8,45			10,45			12,50			14,50		
Effective anchorage depth	h_{ef}	[mm]	31	44	35	43	52	43	60	68	50	67	80	58	79	92
Depth of drill hole	$h_0 \geq$	[mm]	45	60	55	65	75	65	85	95	75	95	110	85	110	125
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	8		12			14			16			18		
Max. installation torque for screws with metric connection thread	$T_{inst} \leq$	[Nm]	10		20			40			60			80		
Tangential impact screw driver [1]	$T_{imp,max}$	[Nm]	160		300			400			650			650		

[1] Installation with tangential impact screw driver, with maximum power output $T_{imp,max}$ acc. to manufacturer's instructions is possible

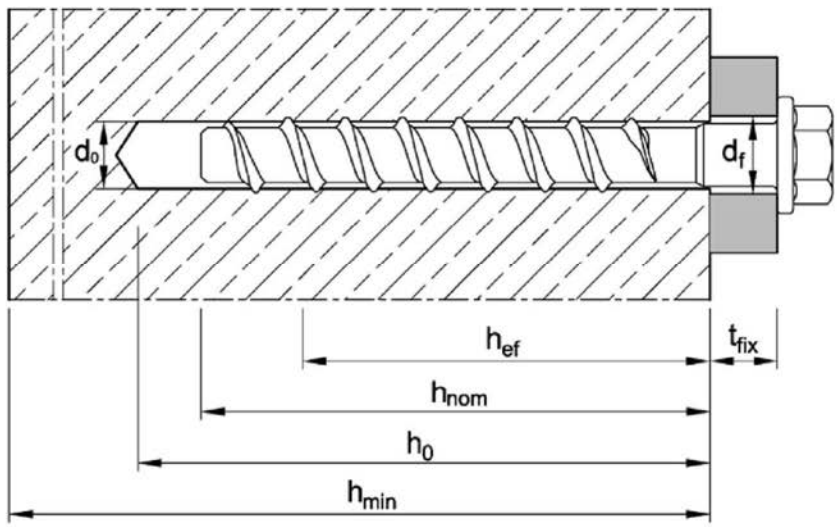


Table B2: Minimum thickness of member, minimum edge distance and minimum spacing

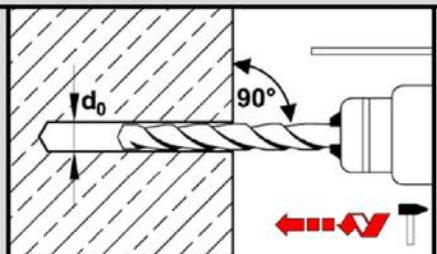
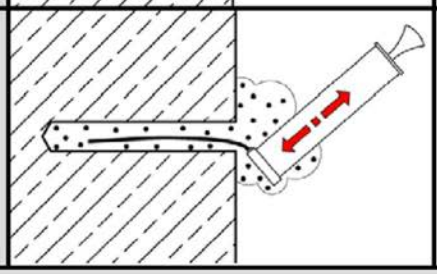
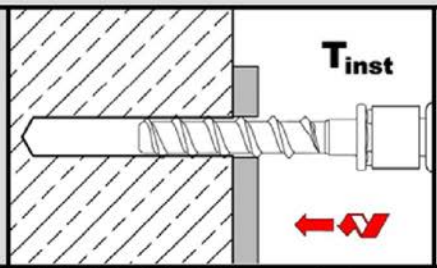
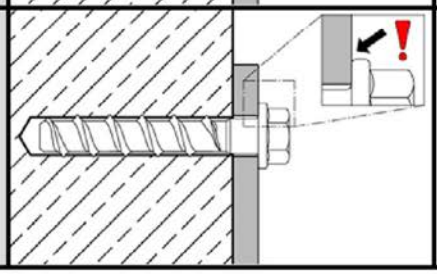
Anchor size			TSM 6		TSM 8			TSM 10			TSM 12			TSM 14		
Nominal embedment depth	h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Minimum thickness of member	h_{min}	[mm]	100		100		120	100	130		120	130	150	130	150	170
Minimum spacing	s_{min}	[mm]	40		40	50		50			50		70	50	70	
Minimum edge distance	c_{min}	[mm]	40		40	50		50			50		70	50	70	

Screwbolt TSM

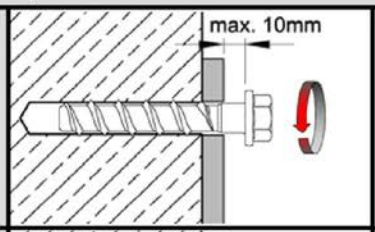
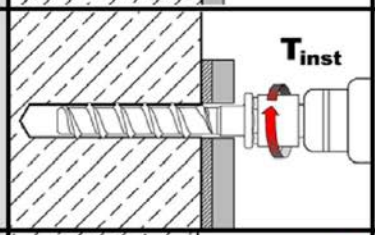
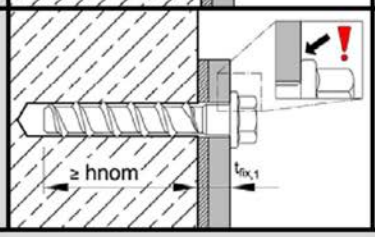
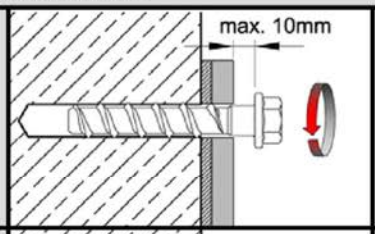
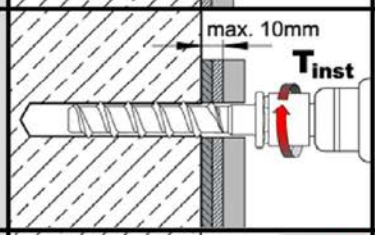
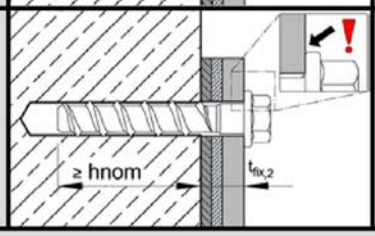
Intended use
Installation parameters / Minimum thickness of concrete member, minimum spacing and edge distance

Annex B2

Installation instructions

Drill hole preparation and cleaning		
1		Drill hole perpendicular to concrete surface. Using a vacuum drill, continue with step 3.
2		Blow out dust or alternatively vacuum clean down to the bottom of the hole.
Installation Screwbolt		
3		Screw in, e.g. with tangential impact screw driver or torque wrench.
4		After installation, the head of the anchor is supported on the fixture and must be undamaged.

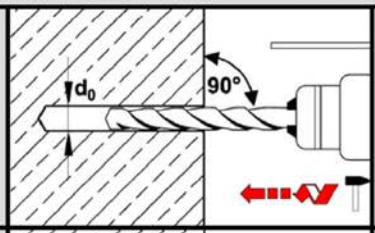
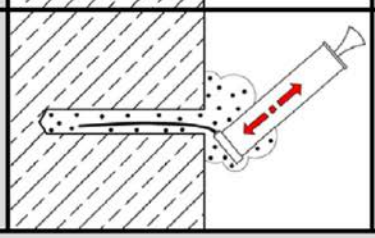
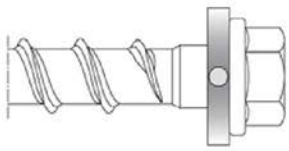
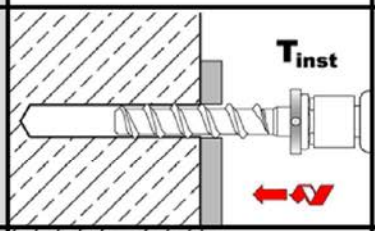
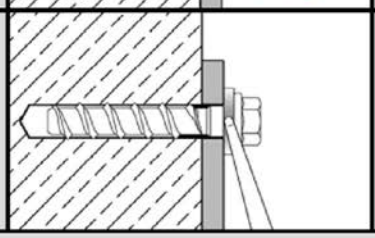
Installation instructions - Adjustment

1. Adjustment		
5		Screw may be untightened maximum 10mm.
6		After adjustment, screw in the concrete screw with tangential impact screw driver or torque wrench.
7		After installation, the head of the anchor is supported on the fixture must be undamaged.
2. Adjustment		
8		Screw may be untightened maximum 10mm.
9		After adjustment, screw in the concrete screw with tangential impact screw driver or torque wrench.
10		After installation, the head of the anchor is supported on the fixture and must be undamaged.

Note:
The fastener may be adjusted max. 2x. The fastener must not be screwed back by more than 10mm in each case. The relining carried out during adjustment must not exceed 10 mm in total.
Nominal embedment depth h_{nom} must still be maintained after the adjustment.

Screwbolt TSM	
Intended use Installation instructions - Adjustment	**Annex B4**

Installation instructions - filling of annular gap

Drill hole preparation and cleaning		
1		Drill hole perpendicular to concrete surface. Using a vacuum drill, continue with step 3.
2		Blow out dust or alternatively vacuum clean down to the bottom of the hole.
Installation Screwbolt with filling washer		
3		Fit the filling washer to the Screwbolt. The thickness of the filling washer must be taken into account with t_{fix}.
4		Screw in, e.g. with tangential impact screw driver or torque wrench.
5		Fill the annular gap between Screwbolt and fixture with mortar (compressive strength ≥ 40 N/mm², e.g. Injection mortar VMH, VMZ or VMU plus). Use enclosed reducing adapter. Observe information on processing of the mortar! The annular gap is completely filled, when excess mortar seeps out.
For seismic loading, the application with and without filling of annular gap is permitted (Annex C3-C4).		

Screwbolt TSM

Intended use
Installation instructions with filling of annular gap

Annex B5

Table C1: Characteristic values for **static** or **quasi-static loads**

Anchor size				**TSM 6**		**TSM 8**			**TSM 10**			**TSM 12**			**TSM 14**		
Nominal embedment depth		h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Installation factor		γ_{inst}	[-]	1,0													
Tension load																	
Steel failure																	
Characteristic resistance		$N_{Rk,s}$	[kN]	14		27			45			67			94		
Partial factor		$\gamma_{Ms,N}$	[-]	1,5													
Pull-out																	
Characteristic resistance in concrete C20/25	cracked	$N_{Rk,p}$	[kN]	2,0	4,0	5,0	9,0	12	9,0	≥ $N^0_{Rk,c}$ [1]		12	≥ $N^0_{Rk,c}$ [1]		≥ $N^0_{Rk,c}$ [1]		
	uncracked	$N_{Rk,p}$	[kN]	4,0	9,0	7,5	12	16	12	20	26	16					
Increasing factor for $N_{Rk,p}$ $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25)		Ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$													
Concrete cone failure																	
Effective anchorage depth		h_{ef}	[mm]	31	44	35	43	52	43	60	68	50	67	80	58	79	92
Spacing		$s_{cr,N}$	[mm]	3 h_{ef}													
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}													
Factor k_1	cracked	$k_{cr,N}$	[-]	7,7													
	uncracked	$k_{ucr,N}$	[-]	11,0													
Splitting																	
Characteristic resistance		$N^0_{Rk,sp}$	[kN]	min [$N_{Rk,p}$; $N^0_{Rk,c}$ [1]]													
Spacing		$s_{cr,sp}$	[mm]	120	160	120	140	150	140	180	210	150	210	240	180	240	280
Edge distance		$c_{cr,sp}$	[mm]	60	80	60	70	75	70	90	105	75	105	120	90	120	140
Shear load																	
Steel failure <u>without</u> lever arm																	
Characteristic resistance		$V^0_{Rk,s}$	[kN]	7,0		13,5		17,0	22,5	34,0		33,5	42,0		56,0		
Partial factor		$\gamma_{Ms,V}$	[-]	1,25													
Ductility factor		k_7	[-]	0,8													
Steel failure <u>with</u> lever arm																	
Characteristic bending resistance		$M^0_{Rk,s}$	[Nm]	10,9		26			56			113			185		
Concrete pry-out failure																	
Pry-out factor		k_8	[-]	1,0		1,0			1,0	2,0		1,0	2,0		1,0	2,0	
Concrete edge failure																	
Effective length of anchor		$l_f = h_{ef}$	[mm]	31	44	35	43	52	43	60	68	50	67	80	58	79	92
Outside diameter of anchor		d_{nom}	[mm]	6		8			10			12			14		

[1] $N^0_{Rk,c}$ according to EN 1992-4:2018

Screwbolt TSM

Performance
Characteristic values for **static** or **quasi-static loads**

Annex C1

Table C2: Characteristic values for **seismic loading**, performance category **C1**

Anchor size			**TSM 6**		**TSM 8**	**TSM 10**		**TSM 12**	**TSM 14**
Nominal embedment depth	h_{nom}	[mm]	40	55	65	55	85	100	115
Installation factor	γ_{inst}	[-]	1,0						
Tension load	**Version: BI, B, SU…TX, SU, S, SK, LK, LP, BSK, ST, IM**								
Steel failure									
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	14		27	45		67	94
Partial factor	γ_{Ms}	[-]	1,5						
Pull-out									
Characteristic resistance	$N_{Rk,p,C1}$	[kN]	2,0	4,0	12	9,0	$\geq N^0_{Rk,c}$ [1)]		
Concrete cone failure									
Effective anchorage depth	h_{ef}	[mm]	31	44	52	43	68	80	92
Spacing	$s_{cr,N}$	[mm]	$3h_{ef}$						
Edge distance	$c_{cr,N}$	[mm]	$1{,}5h_{ef}$						
Shear load	**Version: BI, B, SU…TX, SU, S, SK, LK, LP**								
Steel failure <u>without</u> lever arm									
Characteristic resistance	$V_{Rk,s,C1}$	[kN]	4,7	5,5	8,5	13,5	15,3	21,0	22,4
Partial factor	γ_{Ms}	[-]	1,25						
Concrete pry-out failure									
Pry-out factor	k_8	[-]	1,0			2,0			
Concrete edge failure									
Effective length of anchor	$l_f = h_{ef}$	[mm]	31	44	52	43	68	80	92
Outside diameter of anchor	d_{nom}	[mm]	6		8	10		12	14
Factor for filling of annular gap									
<u>with</u> filling of annular gap (acc. to Annex B5, figure 5)	α_{gap}	[-]	1,0						
<u>without</u> filling of annular gap (acc. to Annex B3)	α_{gap}	[-]	0,5						

[1)] $N^0_{Rk,c}$ for concrete strength class C20/25, according to EN 1992-4:2018

Table C3: Characteristic values for **seismic loading**, performance category **C2, with filling of annular gap,** Screwbolt TSM zinc plated

Anchor size			**TSM 8**	**TSM 10**	**TSM 12**	**TSM 14**
Nominal embedment depth	h_{nom}	[mm]	65	85	100	115
Installation factor	γ_{inst}	[-]	1,0			
Tension load	**Version: BI, B, SU…TX, SU, S, LK, LP**					
Steel failure						
Characteristic resistance	$N_{Rk,s,C2}$	[kN]	27	45	67	94
Partial factor	γ_{Ms}	[-]	1,5			
Pull-out						
Characteristic resistance	$N_{Rk,p,C2}$	[kN]	2,4	5,4	7,1	10,5
Concrete cone failure						
Effective anchorage depth	h_{ef}	[mm]	52	68	80	92
Spacing	$s_{cr,N}$	[mm]	$3h_{ef}$			
Edge distance	$c_{cr,N}$	[mm]	$1{,}5h_{ef}$			
Shear load	**Version: BI, B, SU…TX, SU, S, LK, LP**					
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s,C2}$	[kN]	9,9	18,5	31,6	40,7
Partial factor	γ_{Ms}	[-]	1,25			
Concrete pry-out failure						
Pry-out factor	k_8	[-]	1,0	2,0		
Concrete edge failure						
Effective length of anchor	$l_f = h_{ef}$	[mm]	52	68	80	92
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	14
Factor for filling of annular gap						
with filling of annular gap (acc. to Annex B5, figure 5)	α_{gap}	[-]	1,0			

Table C4: Characteristic values for **seismic loading**, performance category **C2, without filling of annular gap,** Screwbolt TSM zinc plated

Anchor size			**TSM 8**	**TSM 10**	**TSM 12**	**TSM 14**
Nominal embedment depth	h_{nom}	[mm]	65	85	100	115
Installation factor	γ_{inst}	[-]	1,0			
Tension loads						
Steel failure	**Version: BI, B, SU…TX, SU, S, LK, LP**					
Characteristic resistance	$N_{Rk,s,C2}$	[kN]	27	45	67	94
Partial factor	γ_{Ms}	[-]	1,5			
Pull-out	**Version: BI, B, SU…TX, SU, S, LK, LP**					
Characteristic resistance	$N_{Rk,p,C2}$	[kN]	2,4	5,4	7,1	10,5
Steel failure	**Version: SK**					
Characteristic resistance	$N_{Rk,s,C2}$	[kN]	27	45	no performance assessed	
Partial factor	γ_{Ms}	[-]	1,5			
Pull-out	**Version: SK**					
Characteristic resistance	$N_{Rk,p,C2}$	[kN]	2,4	5,4	no performance assessed	
Concrete cone failure	**Version: BI, B, SU…TX, SU, S, SK, LK, LP**					
Effective anchorage depth	h_{ef}	[mm]	52	68	80	92
Spacing	$s_{cr,N}$	[mm]	3 h_{ef}			
Edge distance	$c_{cr,N}$	[mm]	1,5 h_{ef}			
Shear loads						
Steel failure <u>without</u> lever arm	**Version: BI, B, SU…TX, SU, S, SK, LK, LP**					
Characteristic resistance	$V_{Rk,s,C2}$	[kN]	10,3	21,9	24,4	23,3
Partial factor	γ_{Ms}	[-]	1,25			
Steel failure <u>without</u> lever arm	**Version: SK**					
Characteristic resistance	$V_{Rk,s,C2}$	[kN]	3,6	13,7	no performance assessed	
Partial factor	γ_{Ms}	[-]	1,25			
Concrete pry-out failure	**Version: BI, B, SU…TX, SU, S, SK, LK, LP**					
Pry-out factor	k_8	[-]	1,0	2,0		
Concrete edge failure	**Version: BI, B, SU…TX, SU, S, SK, LK, LP**					
Effective length of anchor	$l_f = h_{ef}$	[mm]	52	68	80	92
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	14
Factor for annular gap **<u>without</u>** filling of annular gap	α_{gap}	[-]	0,5			

Screwbolt TSM

Performance
Characteristic resistance for **seismic loading**, performance category **C2**
<u>without</u> filling of annular gap

Annex C4

Table C5: Characteristic values of resistance under **fire exposure**

Anchor size				**TSM 6**		**TSM 8**			**TSM 10**			**TSM 12**			**TSM 14**		
Nominal anchorage depth		h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Steel failure (tension and shear resistance)																	
Characteristic resistance	R30	$N_{Rk,s,fi}$ = $V_{Rk,s,fi}$	[kN]	0,9		2,4			4,4			7,3			10,3		
	R60			0,8		1,7			3,3			5,8			8,2		
	R90			0,6		1,1			2,3			4,2			5,9		
	R120			0,4		0,7			1,7			3,4			4,8		
Steel failure <u>with</u> lever arm																	
Characteristic bending resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	0,7		2,4			5,9			12,3			20,4		
	R60			0,6		1,8			4,5			9,7			15,9		
	R90			0,5		1,2			3,0			7,0			11,6		
	R120			0,3		0,9			2,3			5,7			9,4		
Edge distance		$c_{cr,fi}$	[mm]	2 h_{ef}													
In case of fire attack from more than one side, the minimum edge distance shall be ≥ 300 mm																	
Spacing		$s_{cr,fi}$	[mm]	4 h_{ef}													
The characteristic resistance for pull-out $N_{Rk,p,fi}$, concrete cone failure $N^0_{Rk,c,fi}$, concrete pry-out $V_{Rk,cp,fi}$ and concrete edge failure $V^0_{Rk,c,fi}$ shall be calculated according to EN 1992-4:2018.																	
The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given values																	

Table C6: Displacements under static or quasi-static loads

Anchor size			TSM 6		TSM 8			TSM 10			TSM 12			TSM 14		
Nominal embedment depth	h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Tension load																
cracked concrete – Tension load	N	[kN]	0,95	1,9	2,4	4,3	5,7	4,3	7,9	9,6	5,7	9,4	12,3	7,6	12,0	15,1
cracked concrete – Displacement	δ_{N0}	[mm]	0,3	0,6	0,6	0,7	0,8	0,6	0,5	0,9	0,9	0,5	1,0	0,5	0,8	0,7
cracked concrete – Displacement	$\delta_{N\infty}$	[mm]	0,4	0,4	0,6	1,0	0,9	0,4	1,2	1,2	1,0	1,2	1,2	0,9	1,2	1,0
uncracked concrete – Tension load	N	[kN]	1,9	4,3	3,6	5,7	7,6	5,7	9,5	11,9	7,6	13,2	17,2	10,6	16,9	21,2
uncracked concrete – Displacement	δ_{N0}	[mm]	0,4	0,6	0,7	0,9	0,5	0,7	1,1	1,0	1,0	1,1	1,2	0,9	1,2	0,8
uncracked concrete – Displacement	$\delta_{N\infty}$	[mm]	0,4	0,4	0,6	1,0	0,9	0,4	1,2	1,2	1,0	1,2	1,2	0,9	1,2	1,0
Shear load																
Shear load	V	[kN]	3,3		8,6			16,2			20,0			30,5		
Displacement	δ_{V0}	[mm]	1,55		2,7			2,7			4,0			3,1		
Displacement	$\delta_{V\infty}$	[mm]	3,1		4,1			4,3			6,0			4,7		

Table C7: Displacements under **seismic loading**, performance category **C2**
with filling of annular gap, Screwbolt TSM zinc plated

Anchor size			**TSM 8**	**TSM 10**	**TSM 12**	**TSM 14**
Nominal embedment depth	h_{nom}	[mm]	65	85	100	115
Tension load						
Version: BI, B, SU…TX, SU, S, LK, LP						
Displacement DLS	$\delta_{N,C2(DLS)}$	[mm]	0,66	0,32	0,57	1,16
Displacement ULS	$\delta_{N,C2(ULS)}$	[mm]	1,74	1,36	2,36	4,39
Shear load						
Version: BI, B, SU…TX, SU, S, LK, LP (with clearance hole)						
Displacement DLS	$\delta_{V,C2(DLS)}$	[mm]	1,68	2,91	1,88	2,42
Displacement ULS	$\delta_{V,C2(ULS)}$	[mm]	5,19	6,72	5,37	9,27

Table C8: Displacements under **seismic loading**, performance category **C2**
without filling of annular gap, Screwbolt TSM zinc plated

Anchor size			**TSM 8**	**TSM 10**	**TSM 12**	**TSM 14**
Nominal embedment depth	h_{nom}	[mm]	65	85	100	115
Tension load						
Version: BI, B, SU…TX, SU, S, LK, LP						
Displacement DLS	$\delta_{N,C2(DLS)}$	[mm]	0,66	0,32	0,57	1,16
Displacement ULS	$\delta_{N,C2(ULS)}$	[mm]	1,74	1,36	2,36	4,39
Version: SK						
Displacement DLS	$\delta_{N,C2DLS)}$	[mm]	0,66	0,32	no performance assessed	
Displacement ULS	$\delta_{N,C2(ULS)}$	[mm]	1,74	1,36		
Shear load						
Version: BI, B, SU…TX, SU, S, LK, LP (with clearance hole)						
Displacement DLS	$\delta_{V,C2(DLS)}$	[mm]	4,21	4,71	4,42	5,60
Displacement ULS	$\delta_{V,C2(ULS)}$	[mm]	7,13	8,83	6,95	12,63
Version: SK (with clearance hole)						
Displacement DLS	$\delta_{V,C2(DLS)}$	[mm]	2,51	2,98	no performance assessed	
Displacement ULS	$\delta_{V,C2(ULS)}$	[mm]	7,76	6,25		