Deutsches Institut für Bautechnik

DIBt

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-16/0655 of 19 May 2020

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Screwbolt TSM
Product family to which the construction product belongs	Mechanical fastener for use in concrete
Manufacturer	Sikla Holding GmbH Kornstraße 4 4614 MARCHTRENK ÖSTERREICH
Manufacturing plant	Sikla Herstellwerk 2
This European Technical Assessment contains	19 pages including 3 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 330011-00-0601 and EAD 330232-00-0601
This version replaces	ETA-16/0655 issued on 30 September 2016

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Specific Part

1 Technical description of the product

The Screwbolt TSM is an anchor in size 6, 8, 10, 12 and 14 mm made of galvanised steel respectively steel with zinc flake coating, made of stainless or high corrosion resistant steel. The anchor 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.

Product and product description is 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 means for 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
Characteristic resistance to tension load (static and quasi-static loading)	See Annex B2 and C1
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C1
Displacements (static and quasi-static loading)	See Annex C6
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex A3, C2, C3, C4 and C7
Durability	See Annex B1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C5

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

In accordance with European Assessment Documents EAD No. 330011-00-0601 and EAD No. 330232-00-0601 the applicable European legal act 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

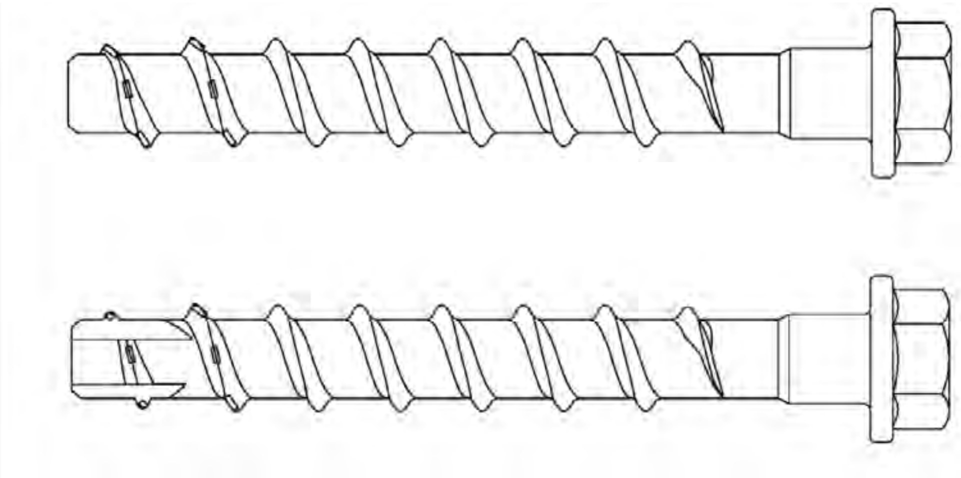
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 19 May 2020 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Baderschneider

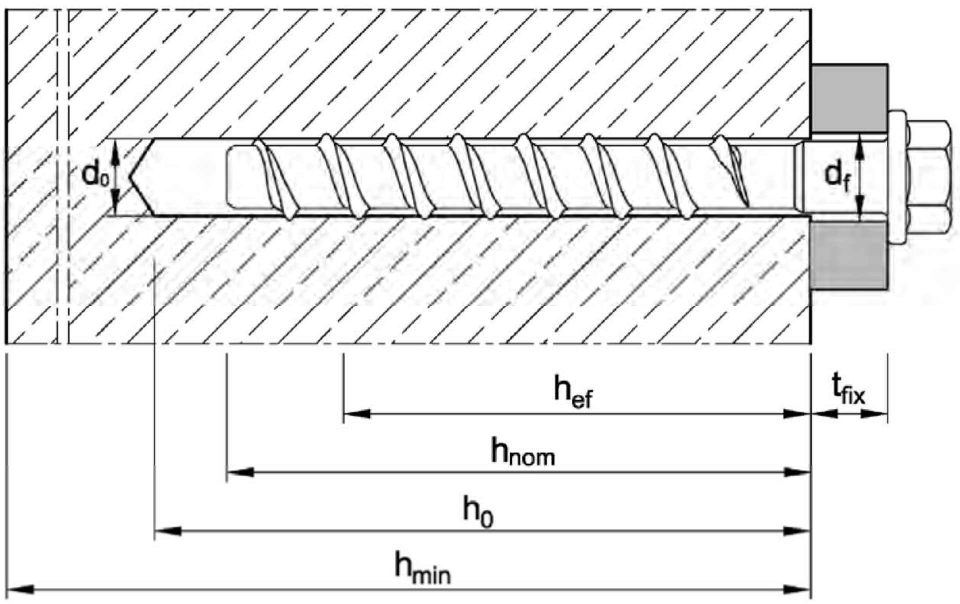
Screwbolt TSM



TSM zinc plated
TSM A4
TSM HCR

Installation situation in concrete

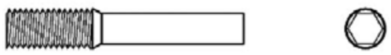
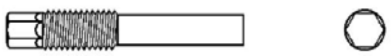
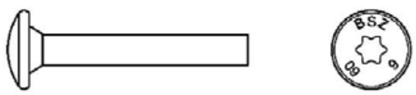
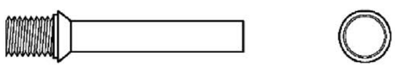
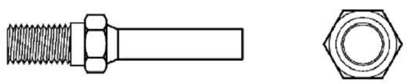
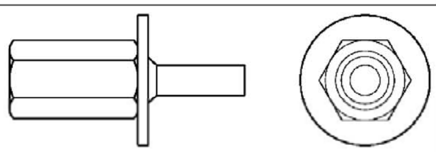
(e.g. Screwbolt TSM with hexagon head and pressed-on washer)



d_0 = nominal drill bit diameter
h_{ef} = effective anchorage depth
h_{nom} = nominal anchorage depth
h_0 = depth of the drill hole
h_{min} = minimum thickness of member
t_{fix} = thickness of fixture
d_f = diameter of clearance hole in the fixture

Screwbolt TSM	**Annex A1**
Product description Product and installation situation	

Table A1: Anchor types and description

	Anchor types	TSM -	Description
1		**BI**	Anchor version with metric connection thread and hexagon socked
2		**B**	Anchor version with metric connection thread and hexagon drive
3		**SU...TX**	Anchor version with hexagon head, pressed-on washer and TORX drive
4		**SU**	Anchor version with hexagon head and pressed-on washer
5		**S**	Anchor version with hexagon head
6		**SK**	Anchor version with countersunk head and TORX drive
7		**LK**	Anchor version with pan head and TORX drive
8		**LP**	Anchor version with large pan head and TORX drive
9		**BSK**	Anchor version with countersunk head and metric connection thread
10		**ST**	Anchor version with hexagon drive and metric connection thread
11		**IM**	Anchor version with internal thread and hexagon drive

Screwbolt TSM

Product description
Anchor types and description

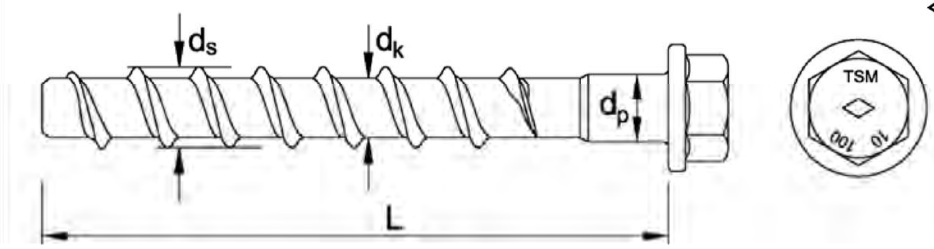
Annex A2

Table A2: Dimensions

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
Length of the anchor	L ≤	[mm]	500													
Core diameter	d_k	[mm]	5,1		7,1			9,1			11,1			13,1		
Outside diameter	d_s	[mm]	7,5		10,6			12,6			14,6			16,6		
Shaft diameter	d_p	[mm]	5,7		7,9			9,9			11,7			13,7		

Marking e.g.: ◇ BSZ 10 100

or TSM 10 100



◇BSZ *or* TSM	Trade name (optional with manufacturer identification ◇)
10	Anchor size
100	Length of anchor
A4	additional marking of stainless steel
HCR	additional marking of high corrosion resistant steel

Table A3: Materials

Version	**Steel, zinc plated** TSM	**Stainless steel** TSM A4	**High corrosion resistant steel** TSM HCR
Material	Steel EN 10263-4:2017 galvanized acc. to EN ISO 4042:2018 or zinc flake coating acc. to EN ISO 10683:2018 (≥ 5µm)	1.4401, 1.4404, 1.4571, 1.4578	1.4529
Nominal characteristic steel yield strength f_{yk}	560 N/mm²		
Nominal characteristic steel ultimate strength f_{uk}	700 N/mm²		
Elongation at fracture A_s	≤ 8%		

Screwbolt TSM	**Annex A3**
Product description Dimensions, marking and materials	

Specifications of Intended use

Screwbolt TSM		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
Anchorages subject to	Static or quasi-static loading	✓													
	Fire exposure	✓													
	Seismic action C1	✓		-		✓	✓	-	✓	-		✓	-		✓
	Seismic action C2 (screwbolt TSM, zinc plated)	-		-		✓	-	-	✓	-		✓	-		✓
Base material	Cracked or uncracked concrete	✓													
	Reinforced or unreinforced concrete (without fibers) acc. to EN 206:2013	✓													
	Strength classes according to EN 206:2013: C20/25 to C50/60	✓													

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
  (zinc plated steel, stainless steel or high corrosion resistant steel)
- Structures subject to external atmospheric exposure including industrial and marine environment or exposure to permanently damp internal condition, if no particular aggressive conditions exist
  (stainless steel or high corrosion resistant steel)
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist (high corrosion resistant steel)
  Note: Particular aggressive conditions are e.g. permanent, alternation immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used)

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.)
- Anchorages are designed according to EN 1992-4:2018 and EOTA Technical Report TR 055.

Installation:

- Making of drill hole by hammer drilling (all sizes) or vacuum drill bit (TSM 8 – TSM 14).
  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 B4: for screwbolt TSM 8 to TSM 14, all anchorage depths

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 manufacturers instructions is possible

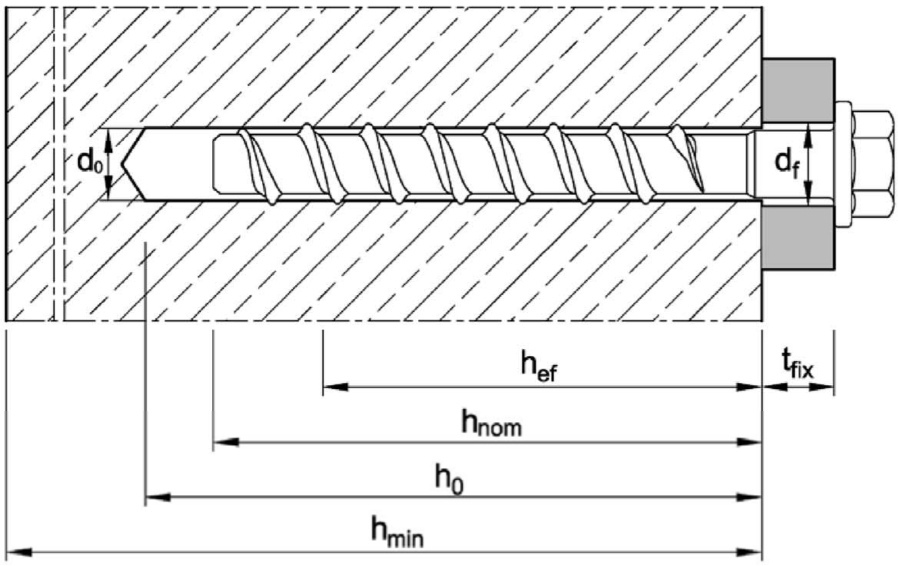


Table B2: Minimum thickness of member, minimum edge distance and minimum spacing

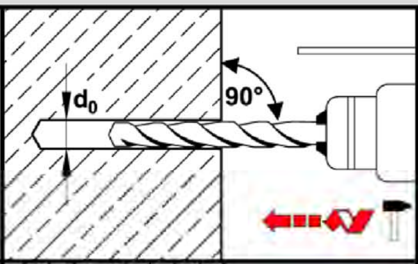
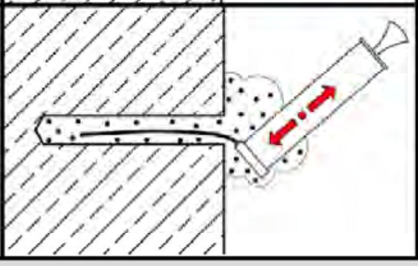
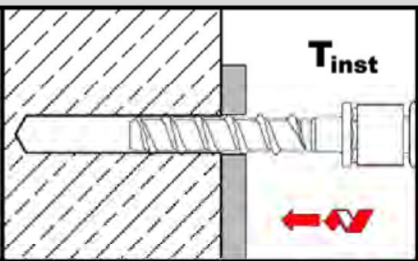
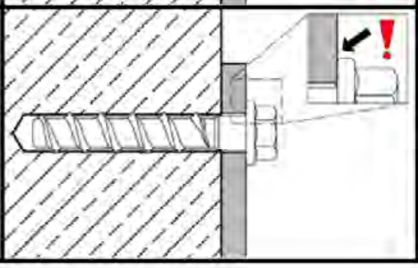
Anchor size			TSM 6		TSM 8			TSM 10			TSM 12			TSM 14		
Nominal embedment depth	h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Minimum thickness of member	h_{min}	[mm]	80		80			80	90	102	80	101	120	87	119	138
Minimum spacing	s_{min}	[mm]	40		40	50		50			50		70	50	70	
Minimum edge distance	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 suction 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.

Screwbolt TSM	**Annex B3**
Intended use Installation instructions	

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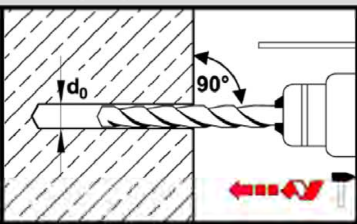
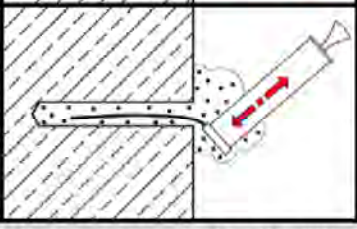
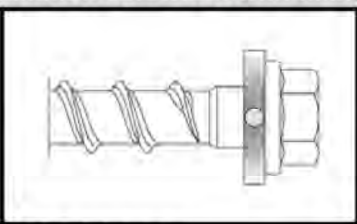
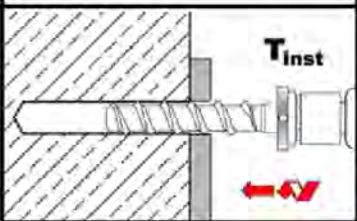
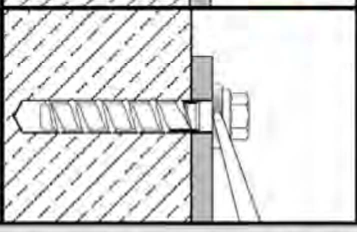
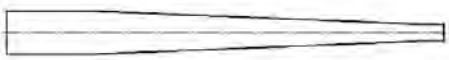
Installation instructions - filling of annular gap

Drill hole preparation and cleaning		
1		Drill hole perpendicular to concrete surface. Using a suction 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 VMZ or VMU plus). Use enclosed reducing adapter. Observe the processing information 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).		

Filling washer and reducing adapter for filling the annular gap between screwbolt and fixture

thickness of filling washer
t = 5 mm

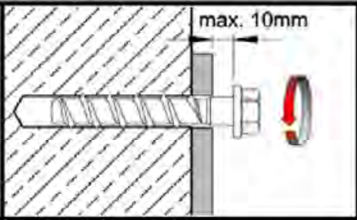
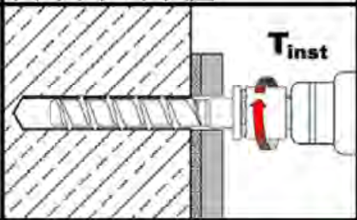
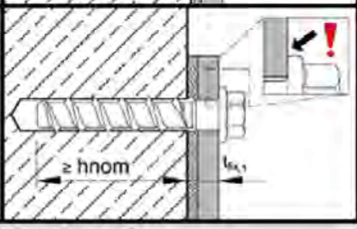


Screwbolt TSM	**Annex B4**
Intended use Installation instructions with filling of annular gap	

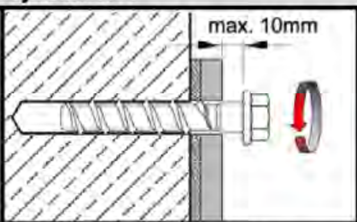
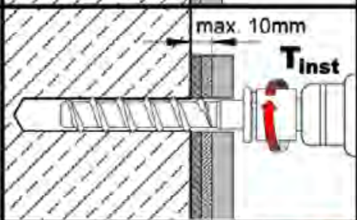
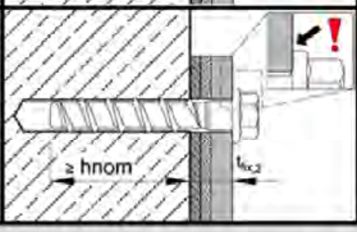
Installation instructions - Adjustment

Drill hole preparation and cleaning: Annex B3, Picture 1 and 2 / Installation: Annex B3, Picture 3 and 4

1. Adjustment

5		Screw may be untightened maximum 10mm.
6		After adjustment, screw in the screwbolt 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 screwbolt 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.

- adjustment for fixings with screwbolt size TSM 8 - TSM 14 for all anchorage depths
- 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	**Annex B5**
Intended use Installation instructions - Adjustment	

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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	$\geq N^0_{Rk,c}$ [1)]		12	$\geq N^0_{Rk,c}$ [1)]		$\geq N^0_{Rk,c}$ [1)]		
Characteristic resistance in concrete C20/25, uncracked	$N_{Rk,p}$	[kN]	4,0	9,0	7,5	12	16	12	20	26	16					
Increasing factor for $N_{Rk,p}$	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													
Factor k_1, uncracked	$k_{ucr,N}$	[-]	11,0													
Splitting																
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	min $[N^0_{Rk,c};\ N_{Rk,p}]$													
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 resistance 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									
Steel failure									
Characteristic resistance	$N_{Rk,s,eq}$	[kN]	14		27	45		67	94
Partial factor	γ_{Ms}	[-]	1,5						
Pull-out									
Characteristic resistance	$N_{Rk,p,eq}$	[kN]	2,0	4,0	12	9,0	$\geq N^0_{Rk,c\ (C20/25)}$ 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									
Steel failure <u>without</u> lever arm									
Characteristic resistance	$V_{Rk,s,eq}$	[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 annular gap – **<u>with</u>** filling of annular gap	α_{gap}	[-]	1,0						
Factor for annular gap – **<u>without</u>** filling of annular gap	α_{gap}	[-]	0,5						

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

Screwbolt TSM

Performance
Characteristic resistance for **seismic loading**, performance category **C1**

Annex C2

Table C3: Characteristic resistance 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						
Steel failure						
Characteristic resistance	$N_{Rk,s.eq}$	[kN]	27	45	67	94
Partial factor	γ_{Ms}	[-]	1,5			
Pull-out						
Characteristic resistance	$N_{Rk,p,eq}$	[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						
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s.eq}$	[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 annular gap **with** filling of annular gap	α_{gap}	[-]	1,0			

Screwbolt TSM

Performance
Characteristic resistance for **seismic loading**, performance category **C2**
with filling of annular gap

Annex C3

Table C4: Characteristic resistance 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							
Hexagon head	**Steel failure**						
	Characteristic resistance	$N_{Rk,s,eq}$	[kN]	27	45	67	94
	Partial factor	γ_{Ms}	[-]	1,5			
	Pull-out						
	Characteristic resistance	$N_{Rk,p,eq}$	[kN]	2,4	5,4	7,1	10,5
Countersunk head	**Steel failure**						
	Characteristic resistance	$N_{Rk,s,eq}$	[kN]	27	45	No performance assessed	
	Partial factor	γ_{Ms}	[-]	1,5		No performance assessed	
	Pull-out						
	Characteristic resistance	$N_{Rk,p,eq}$	[kN]	2,4	5,4	No performance assessed	
Concrete cone failure							
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 without lever arm							
Hexagon head	Characteristic resistance	$V_{Rk,s,eq}$	[kN]	10,3	21,9	24,4	23,3
	Partial factor	γ_{Ms}	[-]	1,25			
Counter-sunk head	Characteristic resistance	$V_{Rk,s,eq}$	[kN]	3,6	13,7	No performance assessed	
	Partial factor	γ_{Ms}	[-]	1,25		No performance assessed	
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 annular gap **without** filling of annular gap		α_{gap}	[-]	0,5			

Screwbolt TSM

Performance
Characteristic resistance for **seismic loading**, performance category **C2**
without 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, concrete cone failure, concrete pry-out and concrete edge failure 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.																	

Screwbolt TSM

Performance
Characteristic values of resistance under **fire exposure**

Annex C5

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
	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
		$\delta_{N\infty}$	[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
	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
		$\delta_{N\infty}$	[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
Querbeanspruchung																	
	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		
		$\delta_{V\infty}$	[mm]	3,1		4,1			4,3			6,0			4,7		

Screwbolt TSM

Performance
Displacements under static or quasi-static loads

Annex C6

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						
Displacement DLS	$\delta_{N,eq(DLS)}$	[mm]	0,66	0,32	0,57	1,16
Displacement ULS	$\delta_{N,eq(ULS)}$	[mm]	1,74	1,36	2,36	4,39
Shear load						
Displacement DLS	$\delta_{V,eq(DLS)}$	[mm]	1,68	2,91	1,88	2,42
Displacement ULS	$\delta_{V,eq(ULS)}$	[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						
Type with **hexagon head**						
Displacement DLS	$\delta_{N,eq(DLS)}$	[mm]	0,66	0,32	0,57	1,16
Displacement ULS	$\delta_{N,eq(ULS)}$	[mm]	1,74	1,36	2,26	4,39
Type with **countersunk head**						
Displacement DLS	$\delta_{N,eq(DLS)}$	[mm]	0,66	0,32	No performance assessed	
Displacement ULS	$\delta_{N,eq(ULS)}$	[mm]	1,74	1,36	No performance assessed	
Shear load						
Type with **hexagon head** and with clearance hole in the fixture						
Displacement DLS	$\delta_{V,eq(DLS)}$	[mm]	4,21	4,71	4,42	5,60
Displacement ULS	$\delta_{V,eq(ULS)}$	[mm]	7,13	8,83	6,95	12,63
Type with **countersunk head** and with clearance hole in the fixture						
Displacement DLS	$\delta_{V,eq(DLS)}$	[mm]	2,51	2,98	No performance assessed	
Displacement ULS	$\delta_{V,eq(ULS)}$	[mm]	7,76	6,25	No performance assessed	

Screwbolt TSM

Performance
Displacements under **seismic loading,** performance category **C2**

Annex C7