Deutsches Institut für Bautechnik DIBt

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

European Technical Assessment

ETA-16/0655 of 30 September 2016

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	Sikla screwbolt TSM
Product family to which the construction product belongs	Concrete screw of sizes 6, 8, 10, 12 and 14 mm for use in concrete
Manufacturer	Sikla Holding Ges.m.b.H. Kornstraße 14 4614 MARCHTRENK ÖSTERREICH
Manufacturing plant	Sikla Herstellwerk 2
This European Technical Assessment contains	16 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	Guideline for European technical approval of "Metal anchor for use in concrete", ETAG 001 Part 3: "Undercut anchors", April 2013, used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 and European Assessment Document (EAD) 330011-00-0601.

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Specific Part

1 Technical description of the product

The Sikla 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 values for static and quasi static action	See Annex C 1 and C 2
Characteristic values for seismic category C1	See Annex C 3
Displacements under tension and shear loads	See Annex C 5

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 C 4

3.3 Safety in use (BWR 4)

The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

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

In accordance with guideline for European technical approval ETAG 001, April 2013 used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011, and European Assessment Document EAD 330011-00-0601 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 30 September 2016 by Deutsches Institut für Bautechnik

Andreas Kummerow
p. p. Head of Department

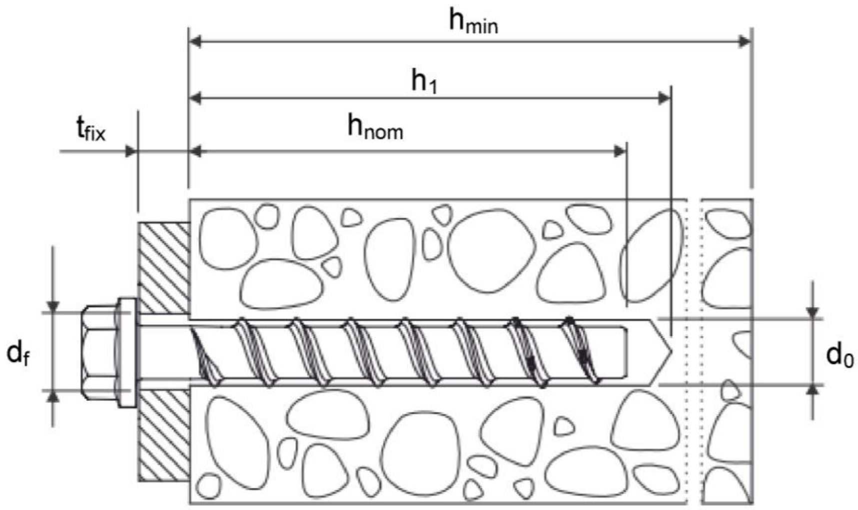
beglaubigt:
Tempel

Product and installation situation

Concrete screw TSM

TSM zinc plated

TSM A4
TSM HCR



d_0	=	nominal drill hole diameter
h_{nom}	=	nominal embedment depth
h_1	=	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

Product description
Product and installation situation

Annex A1

Table A1: Anchor types and description

	Anchor type	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 washer, hexagon head 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

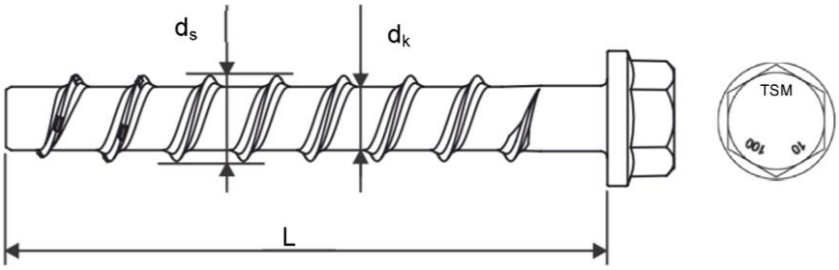
Screwbolt TSM

Product description
Anchor types and description

Annex A2

Table A2: Dimensions

Anchor size			TSM 6		TSM 8			TSM 10			TSM 12			TSM 14		
Nominal embedment 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													
Thread: Core diameter	d_k	[mm]	5,1		7,1			9,1			11,1			13,1		
Thread: Outside diameter	d_s	[mm]	7,5		10,6			12,6			14,6			16,6		



Marking e.g.: ◇ BSZ 10 100
or TSM 10 100

◇ BSZ *or* TSM	Trade name (optional with manufacturer identification ◇)
10	Anchor size
100	Lenght 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 galvanized acc. to EN ISO 4042 or zinc flake coating acc. to EN ISO 10683 (≥ 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

Product description
Dimensions, marking and materials

Annex A3

Intended use

Anchorages subject to:

- Static and quasi-static loads,
- Used for anchorages with requirements related to resistance of fire
- Used for anchorages with seismic actions category C1, sizes 8-14 for maximum embedment depth per anchor size

Base materials:

- Reinforced and unreinforced concrete acc. to EN 206-1:2000-12,
- Strength classes C20/25 to C50/60 acc. to EN 206-1:2000-12,
- Cracked and uncracked concrete

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 of reinforcement or to supports, etc.).
- Anchorages under static and quasi-static actions are designed in accordance with:
  - ETAG 001, Annex C, design method A, Edition August 2010 or
  - CEN/TS 1992-4:2009, design method A.
- Anchorages under fire exposure are designed in accordance with:
  - EOTA Technical Report TR 020, Edition May 2004 or
  - CEN/TS 1992-4:2009, Annex D
    (It must be ensured that local spalling of the concrete cover does not occur)
- Anchorages under seismic actions are designed in accordance with:
  - EOTA Technical Report TR 045, Edition February 2013
  - Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure.
  - Fastenings in stand-off installation or with a grout layer are not allowed.
- The design method according to ETAG 001, Annex C also applies for the specified diameter d_f of clearance hole in the fixture in Annex B2, Table B1.
- In CEN/TS 1992-4-1, section 5.2.3.1 the 3. indent will be replaced as follow: only the most unfavorable anchors of an anchor group take up shear loads, if diameter d_f of the clearance hole is larger than given in CEN/TS 1992-4-1, Table 1.
- The condition according to CEN/TS 1992-4-1, Section 5.2.3.3, no. 3) is also fulfilled for the specified diameter d_f of clearance hole in the fixture in Annex B2, Table B1.

Installation:

- Making of drill hole by hammer drilling,
- 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 and is not damaged.
- The drill hole may be filled with injection mortar MKT TSM-FM.
- Adjustability according to Annex B4, sizes 8-14, all anchorage depths

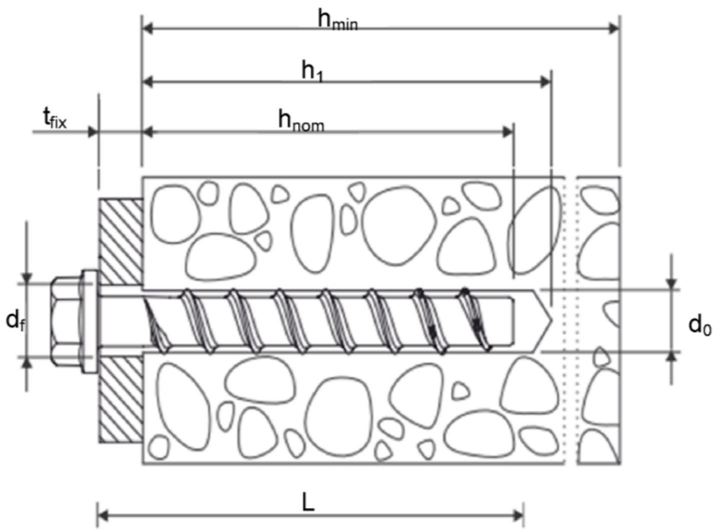
Screwbolt TSM	**Annex B1**
Intended use Specifications	

Table B1: Installation parameters

Anchor size			TSM 6		TSM 8			TSM 10		
Nominal embedment depth	h_{nom}	[mm]	40	55	45	55	65	55	75	85
Nominal drill hole diameter	d_0	[mm]	6		8			10		
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	6,4		8,45			10,45		
Depth of drill hole	$h_1 \geq$	[mm]	45	60	55	65	75	65	85	95
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	8		12			14		
Thickness of fixture	t_{fix}	[mm]	$t_{fix} = L - h_{nom}$							
Max. Installation torque for screws with metric connection thread	$T_{inst} \leq$	[Nm]	10		20			40		
Tangential impact screw driver [1)]	$T_{imp,max}$	[Nm]	160		300			400		

Anchor size			TSM 12			TSM 14		
Nominal embedment depth	h_{nom}	[mm]	65	85	100	75	100	115
Nominal drill hole diameter	d_0	[mm]	12			14		
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	12,5			14,5		
Depth of drill hole	$h_1 \geq$	[mm]	75	95	110	85	110	125
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	16			18		
Thickness of fixture	t_{fix}	[mm]	$t_{fix} = L - h_{nom}$					
Max. Installation torque for screws with metric connection thread	$T_{inst} \leq$	[Nm]	60			80		
Tangential impact screw driver [1)]	$T_{imp,max}$	[Nm]	650			650		

1) Installation with tangential impact screw driver, with maximum power output $T_{imp,max}$ acc. to manufacturers instructions is possible.



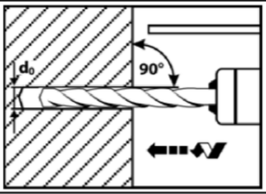
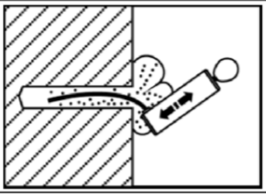
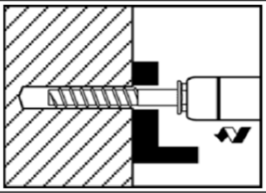
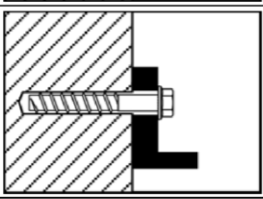
Screwbolt TSM	Annex B2
Intended use Installation parameters	

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

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

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

Installation instruction

1		Drill hole perpendicular to concrete surface.
2		Blow out dust or alternatively vacuum clean down to the bottom of the hole.
3		Screw in anchor, e.g. with tangential impact screw driver.
4		After installation, the head of the anchor is supported on the fixture.

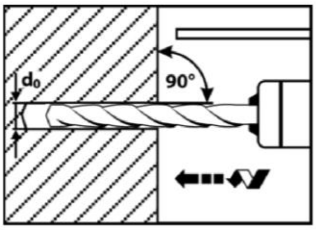
Screwbolt TSM

Intended use
Minimum thickness of concrete member, minimum spacing and edge distance, installation instruction

Annex B3

Installation instruction for adjustment M8-M14

1



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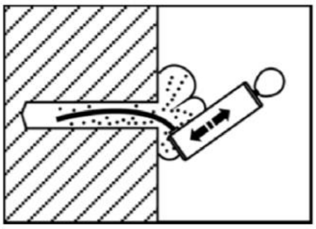

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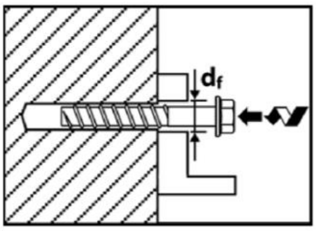

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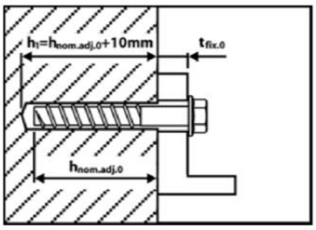

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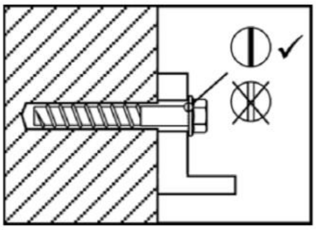

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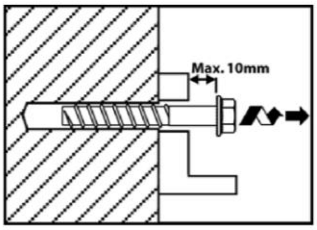

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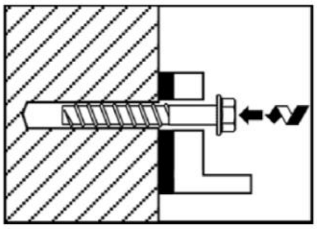

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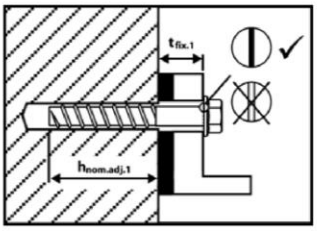

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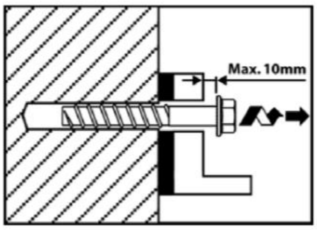

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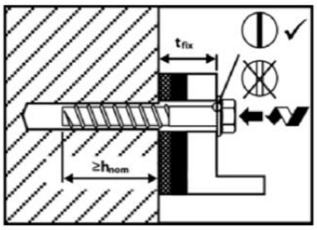

- The anchor may be adjusted at most two times while the anchor may be turned back at most 10 mm.
- The total allowed thickness of shims added during the adjustment process is 10 mm.
- The required setting depth h_{nom} must be maintained after the adjustment. ($h_{nom} = L - t_{fix}$).

Screwbolt TSM

Intended use
Installation instruction for adjustment

Annex B4

Table C1: Characteristic values for **tension loads**

Anchor size				TSM 6		TSM 8			TSM 10		
Nominal embedment depth		h_{nom}	[mm]	40	55	45	55	65	55	75	85
Installation safety factor		$\gamma_2 = \gamma_{inst}$	[-]	1,0							
Steel failure											
Characteristic load		$N_{Rk,s}$	[kN]	14		27			45		
Pull-out failure											
Characteristic tension load in concrete C20/25	cracked	$N_{Rk,p}$	[kN]	2	4	5	9	12	9	1)	
	uncracked	$N_{Rk,p}$	[kN]	4	9	7,5	12	16	12	20	25
Increasing factor for $N_{Rk,p}$ for strength classes > C20/25		ψ_c	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$							
Concrete cone failure											
Effective anchorage depth		h_{ef}	[mm]	31	44	35	43	52	43	60	68
Spacing (Edge distance)		$s_{cr,N}$ ($c_{cr,N}$)	[mm]	3 h_{ef} (1,5 h_{ef})							
Factor for concrete (acc. to CEN/TS 1992-4)	cracked	k_{cr}	[-]	7,2							
	uncracked	k_{ucr}	[-]	10,1							
Splitting											
Spacing		$s_{cr,sp}$	[mm]	120	160	120	140	150	140	180	210
Edge distance		$c_{cr,sp}$	[mm]	60	80	60	70	75	70	90	105

Anchor size				TSM 12			TSM 14		
Nominal embedment depth		h_{nom}	[mm]	65	85	100	75	100	115
Installation safety factor		$\gamma_2 = \gamma_{inst}$	[-]	1,0					
Steel failure									
Characteristic load		$N_{Rk,s}$	[kN]	67			94		
Pull-out failure									
Characteristic tension load in concrete C20/25	cracked	$N_{Rk,p}$	[kN]	12	1)		1)		
	uncracked	$N_{Rk,p}$	[kN]	16					
Increasing factor for $N_{Rk,p}$ for strength classes > C20/25		ψ_c	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$					
Concrete cone failure									
Effective anchorage depth		h_{ef}	[mm]	50	67	80	58	79	92
Spacing (Edge distance)		$s_{cr,N}$ ($c_{cr,N}$)	[mm]	3 h_{ef} (1,5 h_{ef})					
Factor for concrete (acc. to CEN/TS 1992-4)	cracked	k_{cr}	[-]	7,2					
	uncracked	k_{ucr}	[-]	10,1					
Splitting									
Spacing		$s_{cr,sp}$	[mm]	150	210	240	180	240	280
Edge distance		$c_{cr,sp}$	[mm]	75	105	120	90	120	140

1) Pull-out is not decisive

Screwbolt TSM	**Annex C1**
Performance Characteristic values for **tension loads**	

Table C2: Characteristic values for **shear loads**

Anchor size			**TSM 6**		**TSM 8**			**TSM 10**		
Nominal embedment depth	h_{nom}	[mm]	40	55	45	55	65	55	75	85
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0							
Steel failure without lever arm										
Characteristic load	$V_{Rk,s}$	[kN]	7		13,5		17	22,5	34	
Factor of ductility acc. to CEN/TS 1992-4	k_2	[-]	0,8							
Steel failure with lever arm										
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	10,9		26			56		
Concrete pry-out failure										
Factor k acc. to ETAG 001, Annex C or k_3 acc. to CEN/TS 1992-4	$k_{(3)}$	[-]	1,0		1,0			1,0	2,0	
Concrete edge failure										
Effective length of anchor	$l_f = h_{ef}$	[mm]	31	44	35	43	52	43	60	68
Outside diameter of anchor	d_{nom}	[mm]	6		8			10		

Anchor size			**TSM 12**			**TSM 14**		
Nominal embedment depth	h_{nom}	[mm]	65	85	100	75	100	115
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0					
Steel failure without lever arm								
Characteristic load	$V_{Rk,s}$	[kN]	33,5	42		56		
Factor of ductility acc. to CEN/TS 1992-4	k_2	[-]	0,8					
Steel failure with lever arm								
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	113			185		
Concrete pry-out failure								
Factor k acc. to ETAG 001, Annex C or k_3 acc. to CEN/TS 1992-4	$k_{(3)}$	[-]	1,0	2,0		1,0	2,0	
Concrete edge failure								
Effective length of anchor	$l_f = h_{ef}$	[mm]	50	67	80	58	79	92
Outside diameter of anchor	d_{nom}	[mm]	12			14		

Screwbolt TSM

Performance
Characteristic values for **shear loads**

Annex C2

Table C3: Characteristic resistance for **seismic loading**, Category **C1**

Anchor size			**TSM 8**	**TSM 10**	**TSM 12**	**TSM 14**
Nominal embedment depth	h_{nom}	[mm]	65	85	100	115
Installation safety factor	γ_2	[-]	1,0			
Tension load						
Steel failure						
Characteristic resistance	$N_{Rk,s,seis}$	[kN]	27	45	67	94
Pull-out failure						
Characteristic resistance in concrete C20/25 to C50/60	$N_{Rk,p,seis}$	[kN]	12	[1]		
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 load						
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s,seis}$	[kN]	8,5	15,3	21,0	22,4
Concrete pry-out failure						
Factor k acc. to ETAG 001, Annex C	k	[-]	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

[1] Pull-out is not decisive

Screwbolt TSM

Performance
Characteristic values for **seismic loading**, Category **C1**

Annex C3

Table C4: Characteristic values under **fire exposure**

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
Steel failure (tension and shear load)																	
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 with lever arm																	
Characteristic bending moment	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		
Spacing		$s_{cr,fi}$	[mm]	4 h_{ef}													
Edge distance		$c_{cr,fi}$	[mm]	2 h_{ef}													

The characteristic resistance for pull-out, concrete cone failure, concrete pry-out and concrete edge failure shall be calculated according to TR 020 / CEN/TS 1992-4. If no value for $N_{Rk,p}$ is given, in Eq. 2.4 and Eq. 2.5, TR 020 (or Eq. D1 and D.2, CEN/TS 1992-4) $N_{Rk,p}$ must be replaced by the value of $N^0_{Rk,c}$.

Screwbolt TSM

Performance
Characteristic values under **fire exposure**

Annex C4

Table C5: Displacements under tension load

Anchor size					TSM 6		TSM 8			TSM 10		
Nominal embedment depth			h_{nom}	[mm]	40	55	45	55	65	55	75	85
Cracked concrete	Tension load		N	[kN]	0,95	1,9	2,4	4,3	5,7	4,3	7,9	9,6
	Displacement		δ_{N0}	[mm]	0,3	0,6	0,6	0,7	0,8	0,6	0,5	0,9
			$\delta_{N\infty}$	[mm]	0,4	0,4	0,6	1,0	0,9	0,4	1,2	1,2
Uncracked concrete	Tension load		N	[kN]	1,9	4,3	3,6	5,7	7,6	5,7	9,5	11,9
	Displacement		δ_{N0}	[mm]	0,4	0,6	0,7	0,9	0,5	0,7	1,1	1,0
			$\delta_{N\infty}$	[mm]	0,4	0,4	0,6	1,0	0,9	0,4	1,2	1,2

Anchor size				TSM 12			TSM 14		
Nominal embedment depth		h_{nom}	[mm]	65	85	100	75	100	115
Cracked concrete	Tension load	N	[kN]	5,7	9,4	12,3	7,6	12,0	15,1
	Displacement	δ_{N0}	[mm]	0,9	0,5	1,0	0,5	0,8	0,7
		$\delta_{N\infty}$	[mm]	1,0	1,2	1,2	0,9	1,2	1,0
Uncracked concrete	Tension load	N	[kN]	7,6	13,2	17,2	10,6	16,9	21,2
	Displacement	δ_{N0}	[mm]	1,0	1,1	1,2	0,9	1,2	0,8
		$\delta_{N\infty}$	[mm]	1,0	1,2	1,2	0,9	1,2	1,0

Table C6: Displacements under shear load

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
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		

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Performance
Displacements

Annex C5