Deutsches Institut für Bautechnik

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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-16/0656 of 10 October 2019

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	Fasteners for use in concrete for redundant non-structural systems
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	EAD 330747-00-0601
This version replaces	ETA-16/0656 issued on 30 September 2016

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Specific Part

1 Technical description of the product

The Screwbolt TSM in sizes of 5 and 6 mm is an anchor made of zinc-plated steel respectively steel with zinc flake coating and stainless 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 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 3

3.2 Safety in use (BWR 4)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex C 1
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1
Characteristic resistance for all load directions and modes of failure for simplified design	See Annex C 2
Durability	See Annex B 1

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

In accordance with European Assessment Document EAD No. 330747-00-0601, the applicable European legal act is: [97/161/EC].

The system to be applied is: 2+

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

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

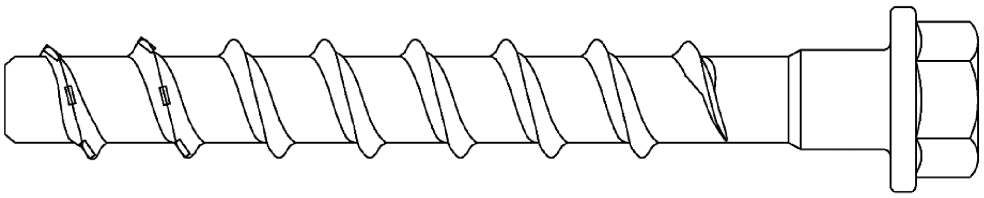
Issued in Berlin on 10 October 2019 by Deutsches Institut für Bautechnik

Dr.-Ing. Lars Eckfeldt
p.p. Head of Department

beglaubigt:
Baderschneider

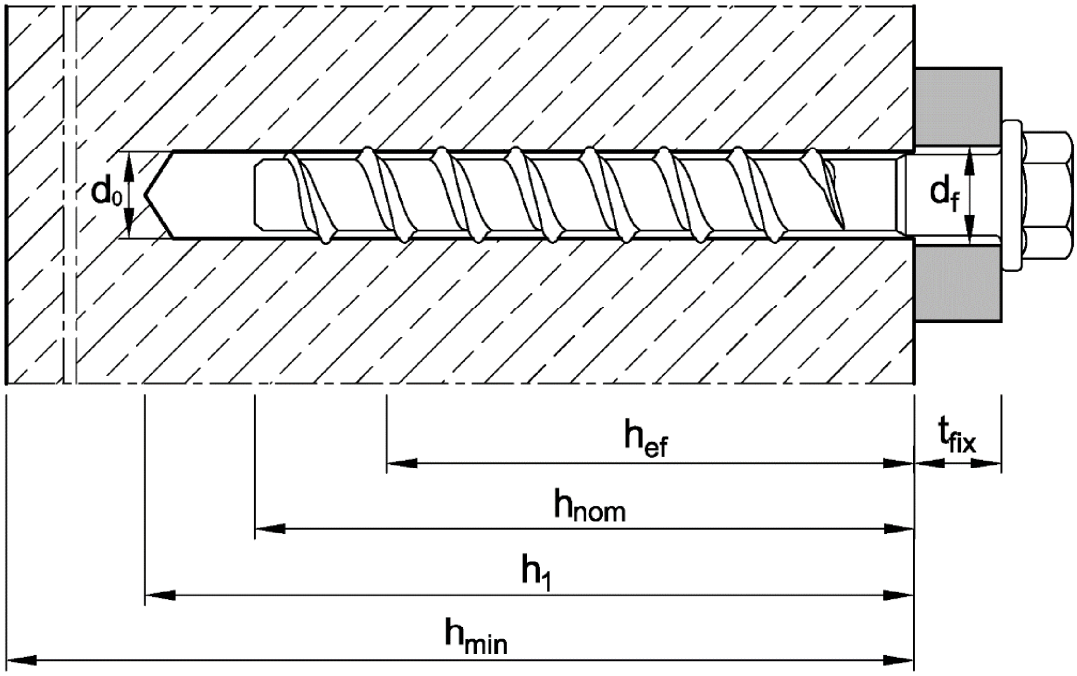
Deutsches Institut für Bautechnik DIBt

Concrete Screw TSM



TSM zinc plated
TSM A4
TSM HCR

Installation situation in concrete



d_0 = nominal drill bit diameter
h_{ef} = effective anchorage depth
h_{nom} = nominal anchorage 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	Annex A1
Product description Product and installation situation in concrete	

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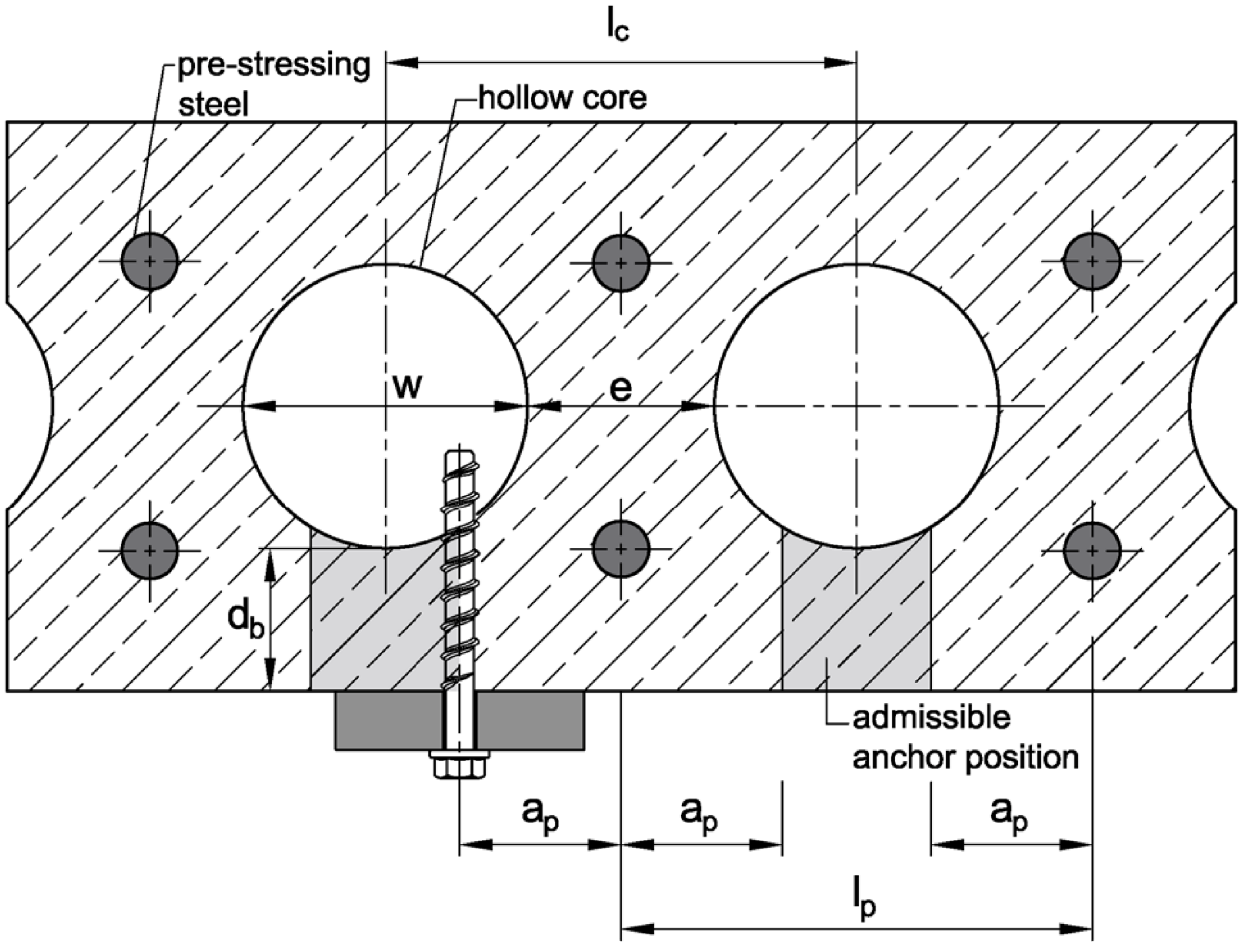
Installation situation in precast hollow core slabs



w / e ≤ 4,2

w	=	core width	
e	=	web thickness	
d_b	=	Flange thickness	
l_c	=	Core distance	$l_c \geq 100$ mm
l_p	=	Pre-stressing steel distance	$l_p \geq 100$ mm
a_p	=	Distance between anchor position and pre-stressing steel	$a_p \geq 50$ mm

Screwbolt TSM	
Product description Installation situation	**Annex A2**

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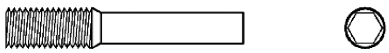
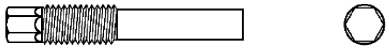
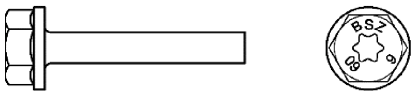
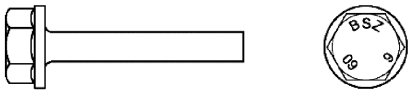
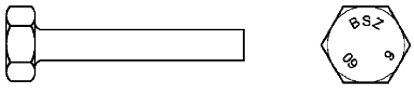
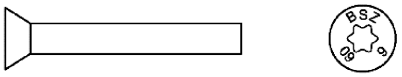
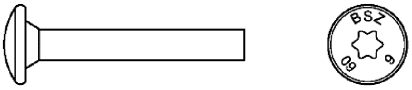
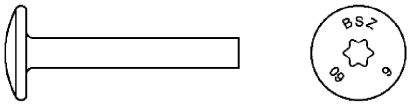
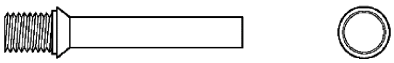
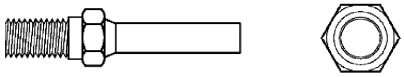
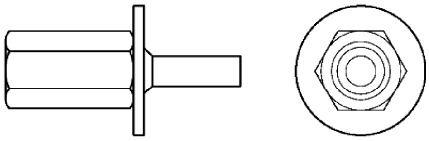
Table A1: Anchor types and description

	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 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		**LPS**	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 A3

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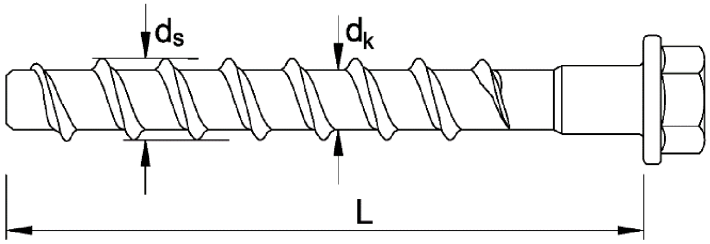
Table A2: Dimensions

Anchor size				TSM 5	TSM 6
Length of the anchor		L ≤	[mm]	200	
Thread	Core diameter	d_k	[mm]	4,0	5,1
	Outside iameter	d_s	[mm]	6,5	7,5



Marking e.g.: ◇ BSZ 6 100
or TSM 6 100

◇ BSZ *or* TSM — Trade name (optional with manufacturer identification ◇)

6 — Anchor size

100 — Length of anchor

A4 — additional marking of stainless steel

HCR — additional marking of high corrosion resistant steel

„k“ *or* „x“ — for anchors with connection thread and h_{nom} = 35 mm

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

Product description
Dimensions, marking and materials

Annex A4

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Specifications of Intended use

Concrete screw TSM		TSM 5	TSM 6
Anchorages subject to	**Redundant non-structural systems** according to EN 1992-4:2018	✓	✓
	Static or quasi-static loads	✓	✓
	Fire exposure in solid concrete	-	✓
Base material	Cracked or uncracked concrete	✓	✓
	Compacted, reinforced or unreinforced concrete (without fibres) according to EN 206:2013	✓	✓
	Strength classes according to EN 206:2013: C20/25 to C50/60	✓	✓
	Precast pre-stressed hollow core slabs: C30/37 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.).
- Design method for anchorages acc. to EN 1992-4:2018 and EOTA Technical Report TR 055:
  - Anchorages in solid concrete: design method A
  - Anchorages in precast pre-stressed hollow core slabs: design method C
  - The design method for shear load also applies for the specified diameter d_f of the clearance hole in the fixture in Annex B2, Table B1.

Installation:

- Making of drill hole by hammer drilling or vacuum drill bit.
- 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.

Screwbolt TSM	Annex B1
Intended use Specifications	

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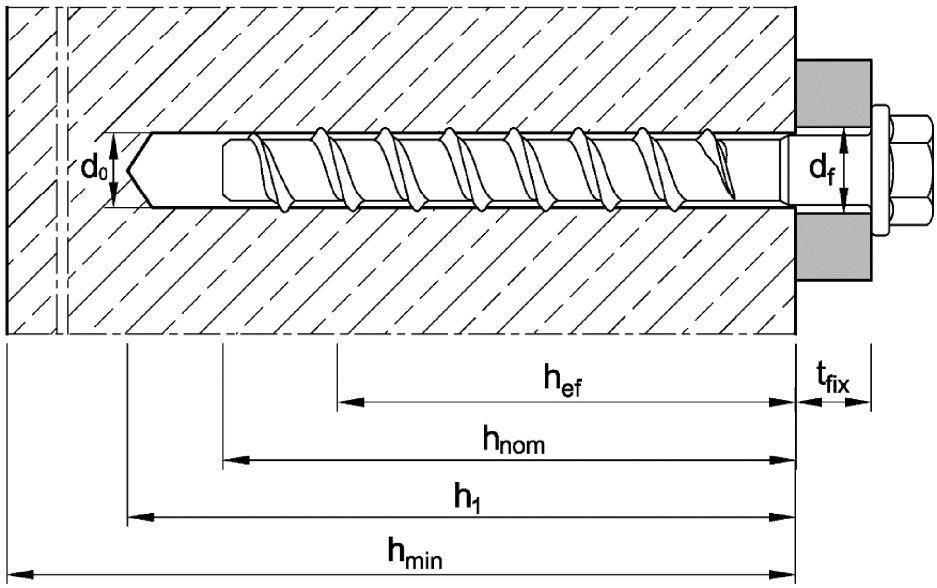
Table B1: Installation parameters

Anchor size			TSM 5	TSM 6	
Nominal embedment depth	h_{nom}	[mm]	35	35	55
Nominal drill bit diameter	d_0	[mm]	5	6	
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	5,4	6,4	
Effective anchorage depth	h_{ef}	[mm]	27	27	44
Depth of drill hole	$h_1 \geq$	[mm]	40	40	60
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	7	8	
Max. Installation torque for screws with metric connection thread	$T_{inst} \leq$	[Nm]	8	10	
Tangential impact screw driver [1)]	$T_{imp,max}$	[Nm]	110	160	

[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** for anchorages in solid concrete

Anchor size			TSM 5	TSM 6	
Nominal embedment depth	h_{nom}	[mm]	35	35	55
Minimum thickness of member	h_{min}	[mm]	80	80	100
Minimum edge distance	c_{min}	[mm]	35	35	40
Minimum spacing	s_{min}	[mm]	35	35	40



Screwbolt TSM

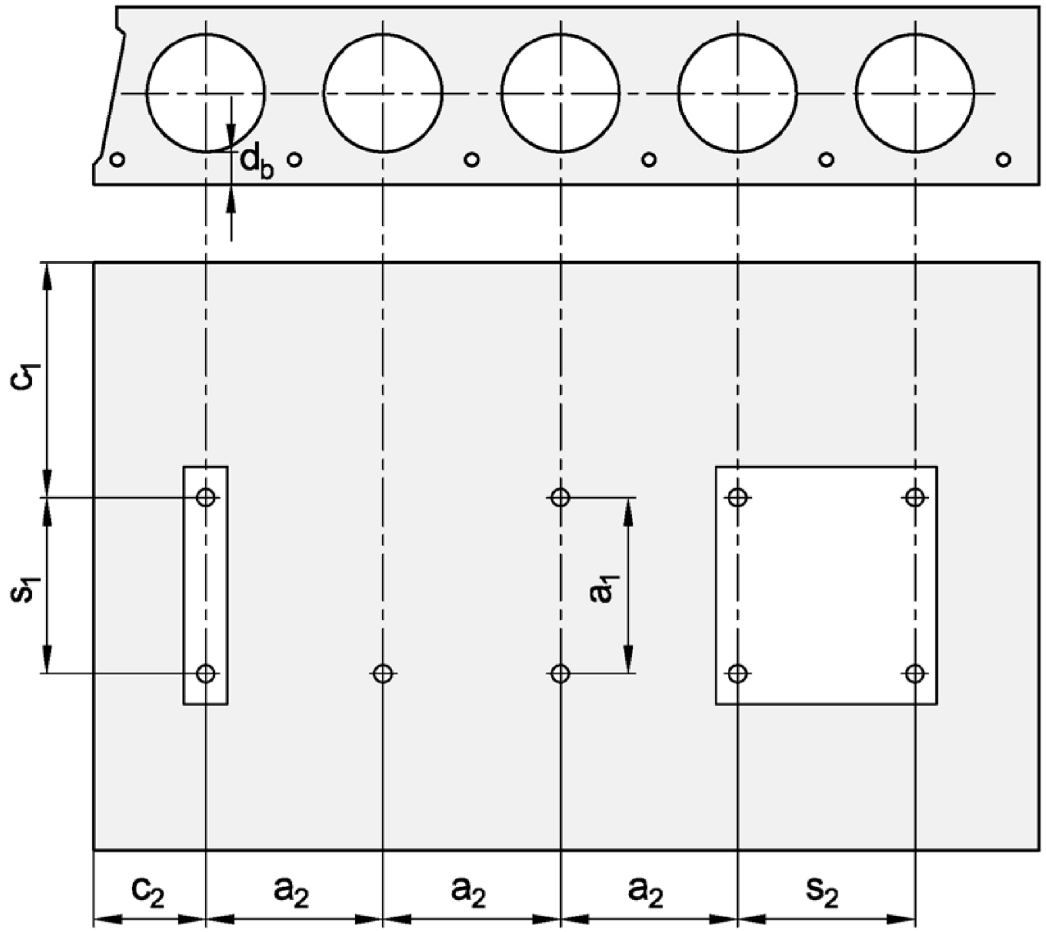
Intended use
Installation parameters
Minimum thickness of concrete member, minimum spacing and edge distance (solid concrete)

Annex B2

Deutsches Institut für Bautechnik DIBt

Table B3: Minimum edge distances and minimum spacing for anchorages in precast pre-stressed hollow core slabs

Anchor size			**TSM 6**		
Flange thickness	d_b	**[mm]**	**≥ 25**	**≥ 30**	**≥ 35**
Minimum edge distance	c_{min}	[mm]	≥ 100 mm		
Minimum spacing	s_{min}	[mm]	≥ 100 mm		
Minimum distance between anchor groups	a_{min}	[mm]	≥ 100 mm		



c_1, c_2 Edge distance

s_1, s_2 Spacing

a_1, a_2 Distance between anchor groups

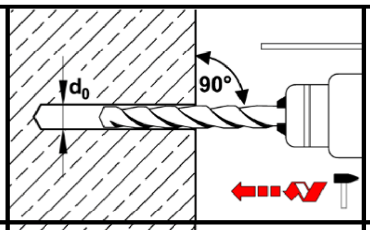
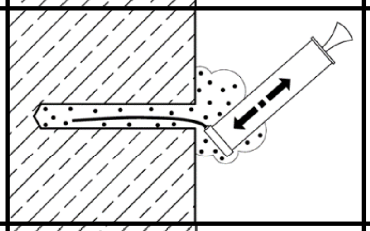
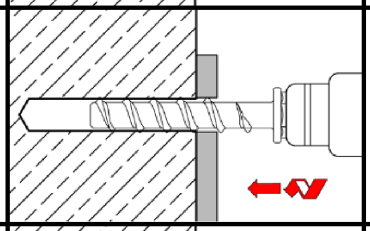
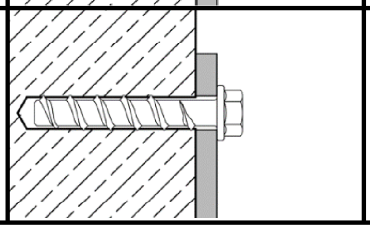
Screwbolt TSM

Intended use
Installation parameters (precast pre-stressed hollow core slabs)

Annex B3

Deutsches Institut für Bautechnik DIBt

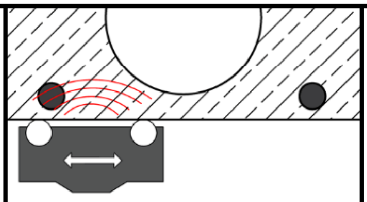
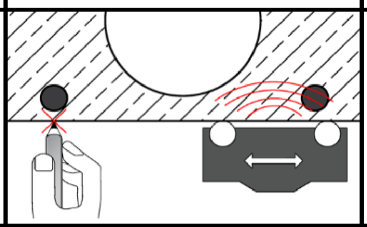
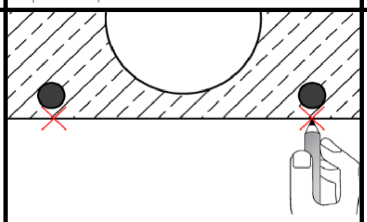
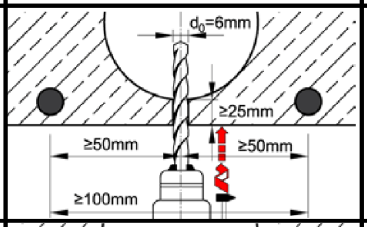
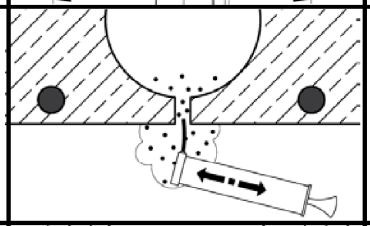
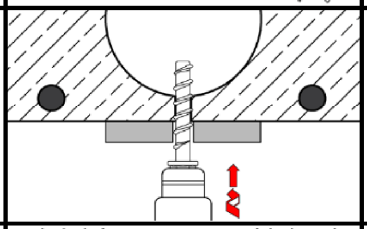
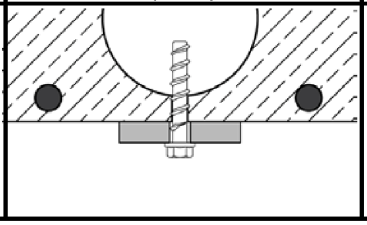
Installation instructions for anchorages in solid concrete slabs

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.
3		Screw in concrete screw, e.g. with tangential impact screw driver or torque wrench.
4		After installation, the head of the anchor is supported on the fixture must be undamaged.

Screwbolt TSM	**Annex B4**
Intended use Installation instructions (solid concrete)	

Deutsches Institut für Bautechnik DIBt

Installation instructions for anchorages in precast pre-stressed hollow core slabs

1		Search for position of pre-stressing steel.
2		Mark position and search for the next position of pre-stressed steel.
3		Mark second position of pre-stressed steel.
4		Drill hole taking into account the installation parameters and distances. Using a suction drill, continue with step 6.
5		Blow out dust or alternatively vacuum drill hole.
6		Screw in concrete screw, e.g. with tangential impact screw driver or torque wrench.
7		After installation, the head of the anchor is supported on the fixture and must be undamaged.

Screwbolt TSM	
Intended use Installation instructions (precast pre-stressed hollow core slabs)	**Annex B5**

Deutsches Institut für Bautechnik DIBt

Table C1: **Characteristic values** for anchorages in solid concrete

Anchor size				**TSM 5**	**TSM 6**	
Nominal embedment depth		h_{nom}	[mm]	35	35	55
Tension load						
Installation factor		γ_{inst}	[-]	1,2	1,0	
Steel failure						
Characteristic resistance		$N_{Rk,s}$	[kN]	8,7	14,0	
Partial factor		$\gamma_{Ms,N}$	[-]	1,5	1,5	
Pull-out						
Characteristic resistance in cracked and uncracked concrete C20/25		$N_{Rk,p}$	[kN]	1,5	3,0	7,5
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]	27	27	44
Spacing		$s_{cr,N}$	[mm]	3 h_{ef}		
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}		
Factor k_1 for concrete	cracked	$k_{cr,N}$	[-]	7,7		
	uncracked	$k_{ucr,N}$	[-]	11,0		
Splitting						
Spacing		$s_{cr,sp}$	[mm]	120	120	160
Edge distance		$c_{cr,sp}$	[mm]	60	60	80
Shear load						
Installation factor		γ_{inst}	[-]	1,0	1,0	
Steel failure without lever arm						
Characteristic resistance		$V^0_{Rk,s}$	[kN]	4,4	7,0	
Partial factor		$\gamma_{Ms,V}$	[-]	1,25	1,25	
Ductility factor		k_7	[-]	0,8	0,8	
Steel failure with lever arm						
Characteristic bending resistance		$M^0_{Rk,s}$	[Nm]	5,3	10,9	
Concrete pry-out failure						
Pry-out factor		k_8	[-]	1,0	1,0	
Concrete edge failure						
Effective length of anchor		$l_f = h_{ef}$	[mm]	27	27	44
Outside diameter of anchor		d_{nom}	[mm]	5	6	

Screwbolt TSM

Performance
Characteristic values for **tension and shear loads** (solid concrete)

Annex C1

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Table C2: Characteristic values of resistance in **precast pre-stressed hollow core slabs** C30/37 to C50/60

Anchor size			**TSM 6**		
Flange thickness	**d_b**	**[mm]**	**≥ 25**	**≥ 30**	**≥ 35**
Characteristic resistance for all directions	F_{Rk}	[kN]	1	2	3
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	10,9		
Edge distance	$c_{cr} = c_{min}$	[mm]	100		
Spacing	$s_{cr} = s_{min}$	[mm]	100		
Partial factor	γ_M	[-]	1,5		
Installation factor	γ_{inst}	[-]	1,0		

Screwbolt TSM

Performance
Characteristic values of resistance in **precast pre-stressed hollow core slabs**

Annex C2

Deutsches Institut für Bautechnik DIBt

Table C3: Characteristic values of resistance under **fire exposure** for anchorages in solid concrete

Anchor size				**TSM 6**			
Material				**Steel, zinc plated**		**Stainless steel A4 / HCR**	
Nominal embedment depth		h_{nom}	[mm]	35	55	35	55
Steel failure (tension and shear resistance)							
Characteristic resistance	R30	$N_{Rk,s,fi}$ = $V_{Rk,s,fi}$	[kN]	0,9		1,2	
	R60			0,8		1,2	
	R90			0,6		1,2	
	R120			0,4		0,8	
Steel failure with lever arm							
Characteristic bending resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	0,7		0,9	
	R60			0,6		0,9	
	R90			0,5		0,9	
	R120			0,3		0,6	
Spacing		$s_{cr,fi}$	[mm]	$4\ h_{ef}$			
Edge distance		$c_{cr,fi}$	[mm]	$2\ h_{ef}$			
The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given values							

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.

Screwbolt TSM

Performance
Characteristic values of resistance under **fire exposure** (solid concrete)

Annex C3