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-16/0656 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.<br>Kornstraße 14<br>4614 MARCHTRENK<br>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 |

**Deutsches Institut für Bautechnik**
Kolonnenstraße 30 B | 10829 Berlin | GERMANY | Phone: +49 30 78730-0 | Fax: +49 30 78730-320 | Email: dibt@dibt.de | www.dibt.de

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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.

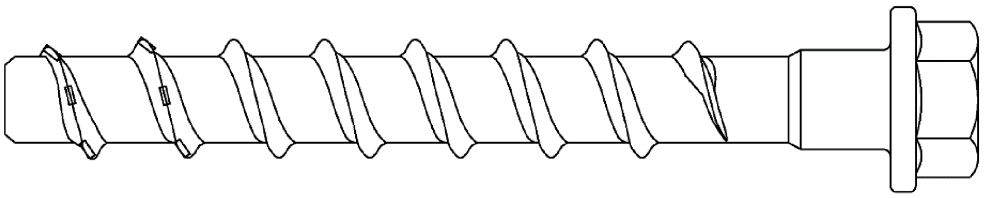
Issued in Berlin on 10 October 2019 by Deutsches Institut für Bautechnik

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

*beglaubigt:*
Baderschneider

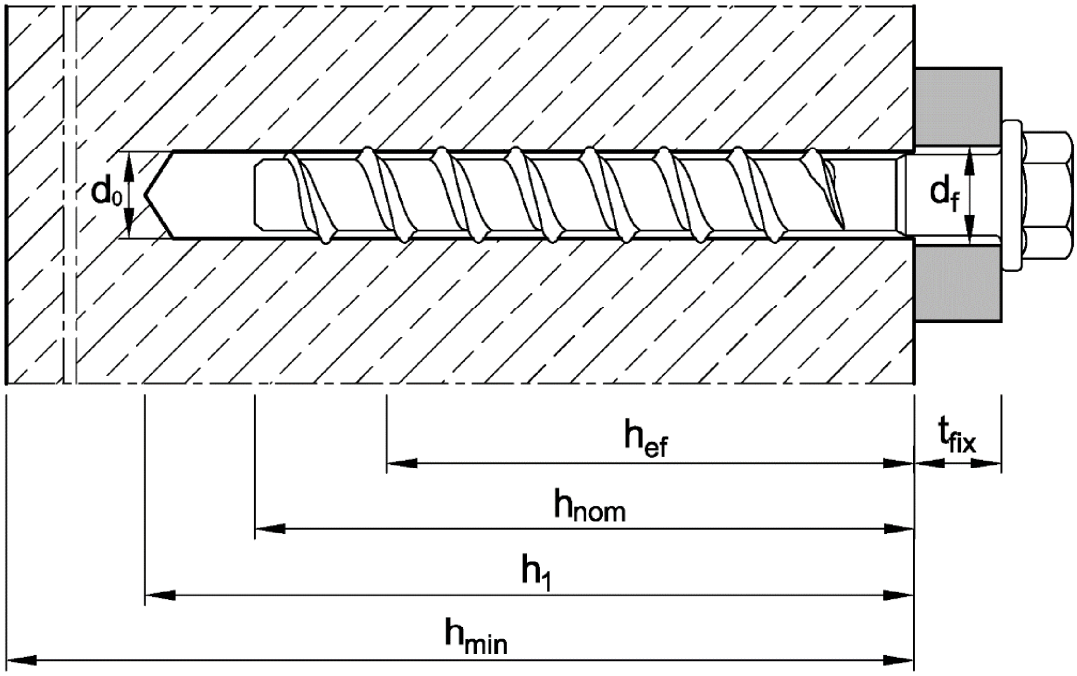
Deutsches Institut für Bautechnik DIBt

## 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**<br>Product and installation situation in concrete | |

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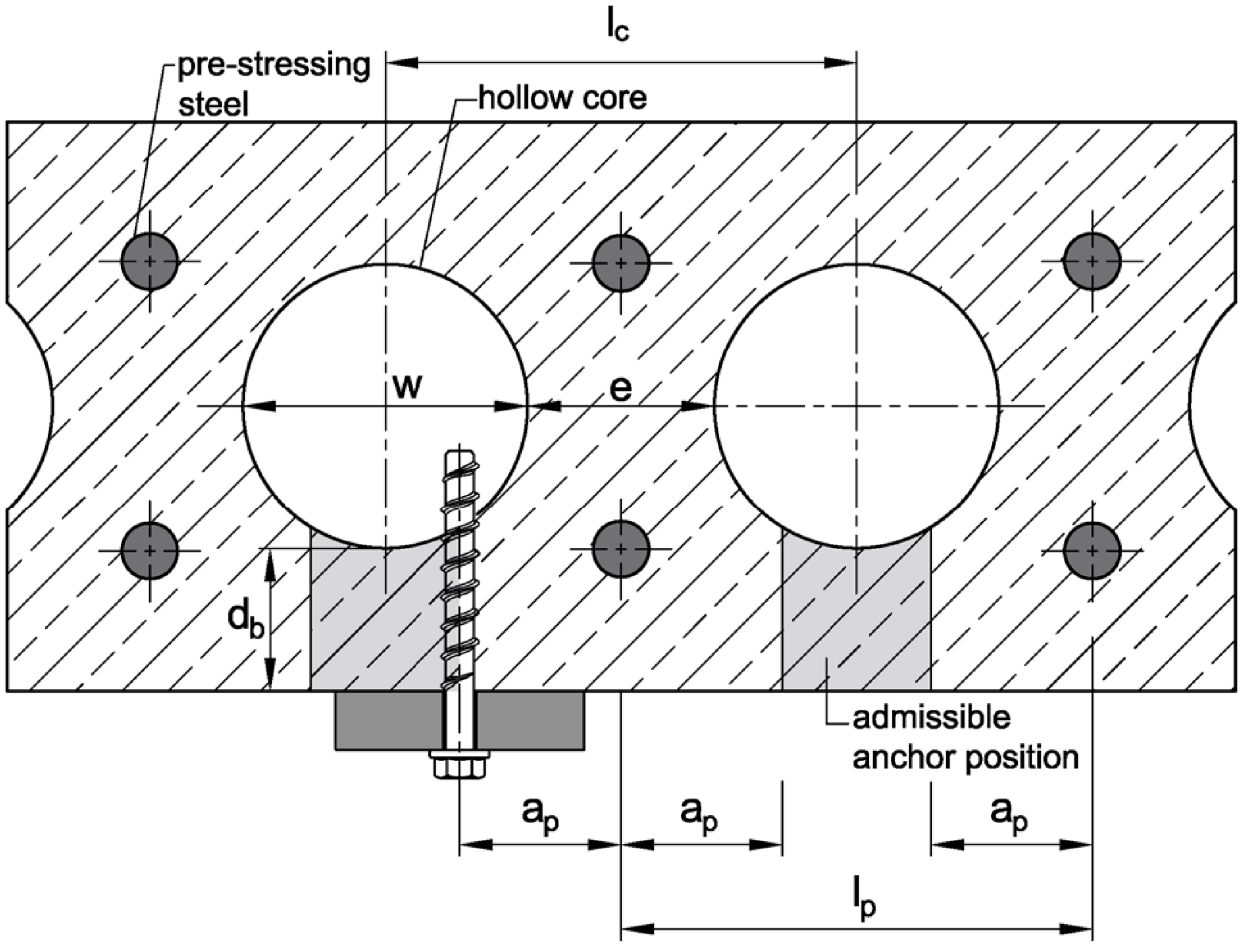
## Installation situation in precast hollow core slabs




**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**<br>Installation situation | **Annex A2** |

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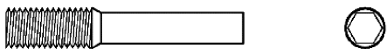
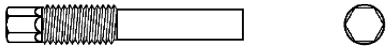
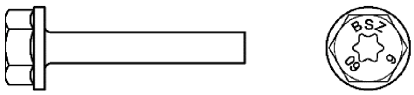
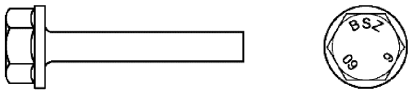
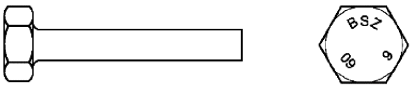
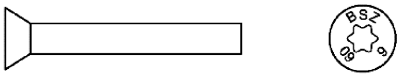
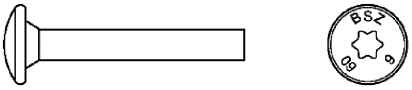
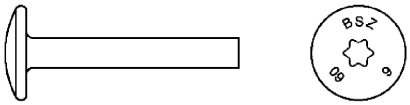
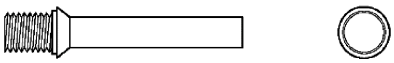
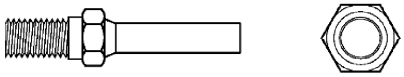
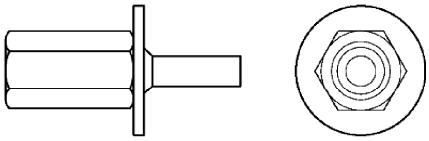
## Table A1: Anchor types and description

| | 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** | **Annex A3** |
|---|---|
| **Product description**<br>Anchor types and description | |

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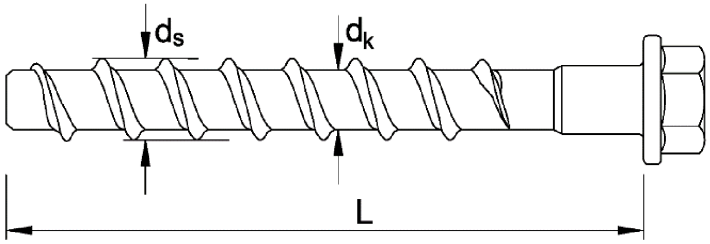
## Table A2: Dimensions

| 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**

## 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**<br>Specifications | |

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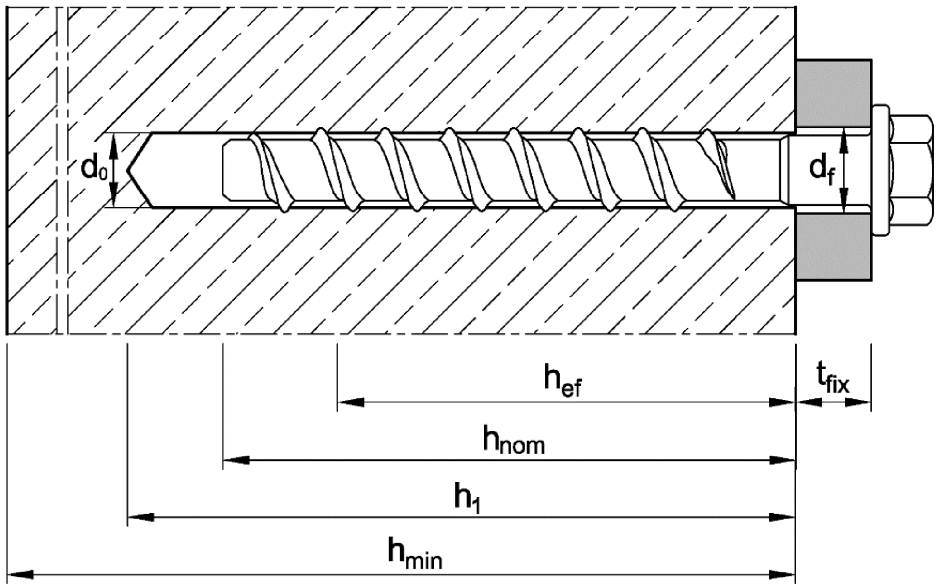
## Table B1: Installation parameters

| **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**

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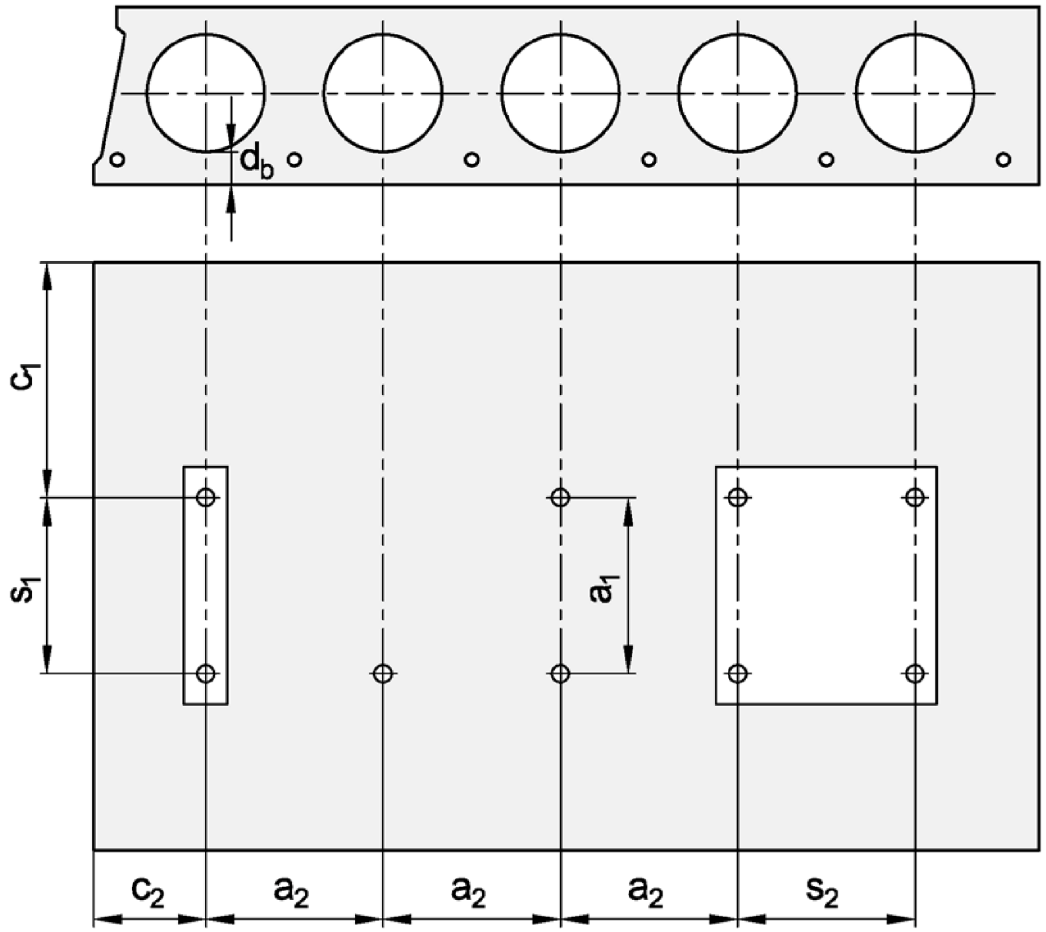
**Table B3: Minimum edge distances and minimum spacing** for anchorages in precast pre-stressed hollow core slabs

| **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

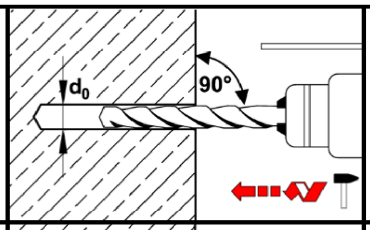
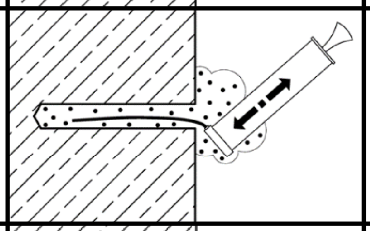
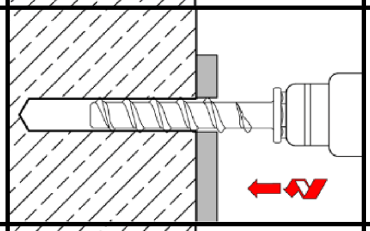
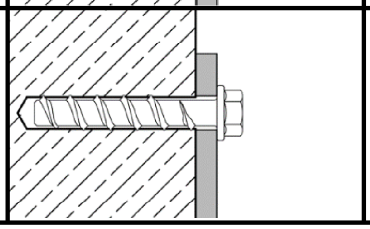
**Screwbolt TSM**

**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**<br>Installation instructions (solid concrete) | |

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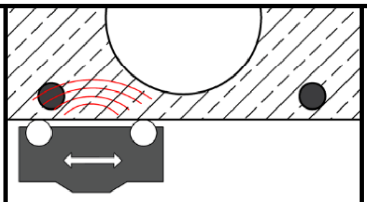
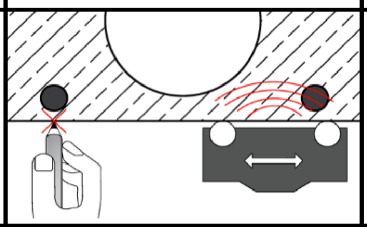
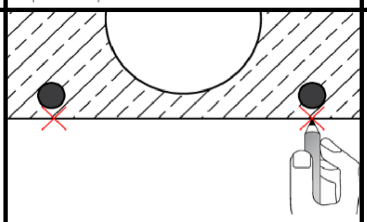
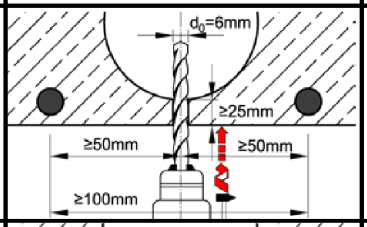
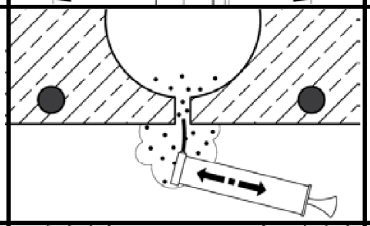
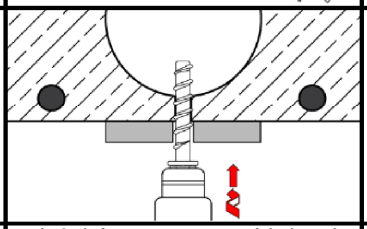
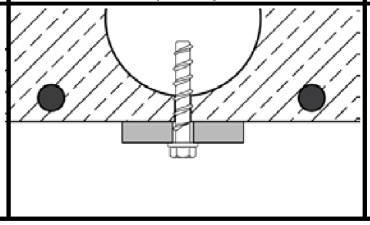
## **Installation instructions** for anchorages in precast pre-stressed hollow core slabs

| | | |
|---|---|---|
| 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.<br>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** | **Annex B5** |
|---|---|
| **Intended use**<br>Installation instructions (precast pre-stressed hollow core slabs) | |

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## 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 | | $\gamma_{inst}$ | [-] | 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 $N_{Rk,p}$ | | $\Psi_C$ | [-] | $\left(\frac{f_{ck}}{20}\right)^{0,5}$ | | |
| **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 | | $\gamma_{inst}$ | [-] | 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 | $\gamma_M$ | [-] | 1,5 | | |
| Installation factor | $\gamma_{inst}$ | [-] | 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** | **Annex C3** |
|---|---|
| **Performance**<br>Characteristic values of resistance under **fire exposure** (solid concrete) | |