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

Member of EOTA www.eota.eu

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 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 size 5 and 6 mm for multiple use for non-structural applications in concrete and in prestressed hollow core slabs |
| 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 | 15 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 anchors for use in concrete", ETAG 001 Part 6: "Anchors for multiple use for non-structural applications", August 2010,<br>used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011. |

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## Specific Part

### 1 Technical description of the product

The Sikla screwbolt TSM in sizes of 5 and 6 mm is an anchor 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)

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

#### 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 3 |

#### 3.3 Safety in use (BWR 4)

| Essential characteristic | Performance |
|---|---|
| Characteristic resistance for tension and shear loads as well as bending moments in concrete | See Annex C 1 and C 2 |
| Edge distances and spacing | See Annex C 1 |

### 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 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.

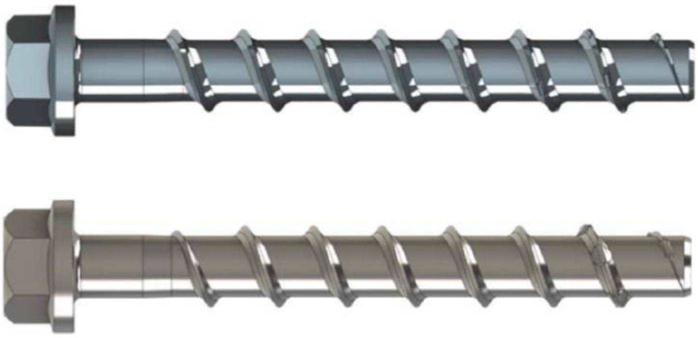
Issued in Berlin on 30 September 2016 by Deutsches Institut für Bautechnik

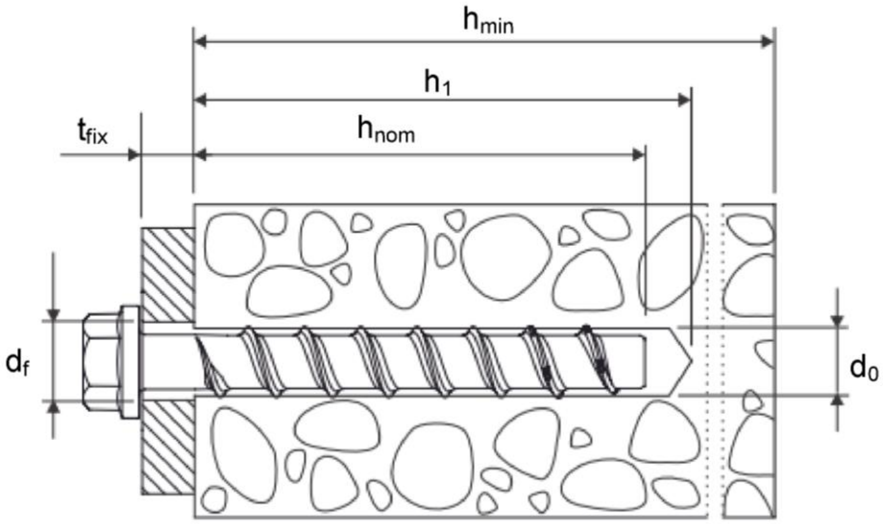
Andreas Kummerow
p. p. Head of Department

*beglaubigt:*
Tempel

## Product and installation situation

### Concrete Screw TSM




| | | |
|---|---|---|
| $d_0$ | = | nominal drill bit diameter |
| $h_{nom}$ | = | 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 |

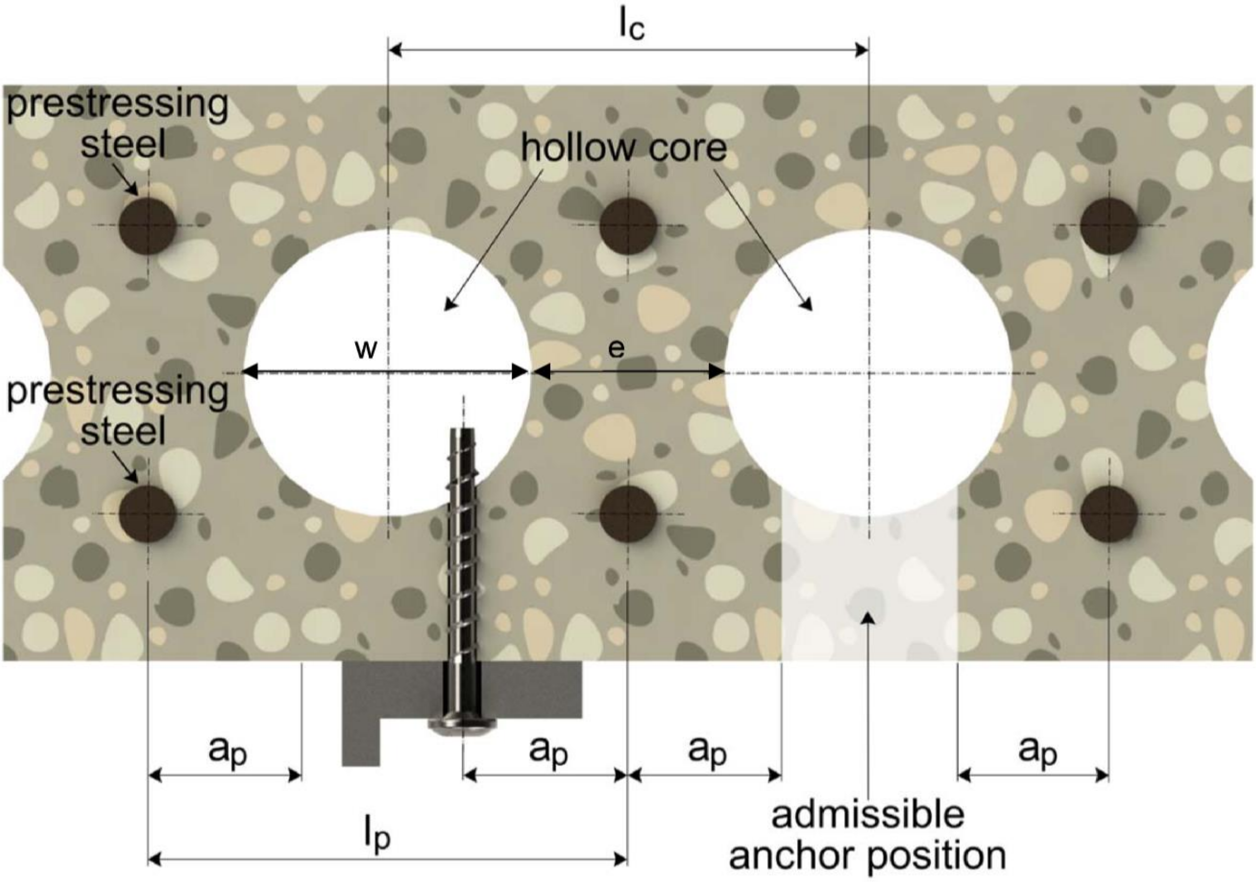


**Screwbolt TSM**

**Product description**
Product and installation situation

**Annex A1**

## Installation situation in precast hollow core slabs




**w / e ≤ 4,2**

| | | |
|---|---|---|
| w | core width | |
| e | web thickness | |
| Core distance | $l_c$ | ≥ 100 mm |
| Prestressing steel | $l_p$ | ≥ 100 mm |
| Distance between anchor position and prestressing steel | $a_p$ | ≥ 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 |  | **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 |

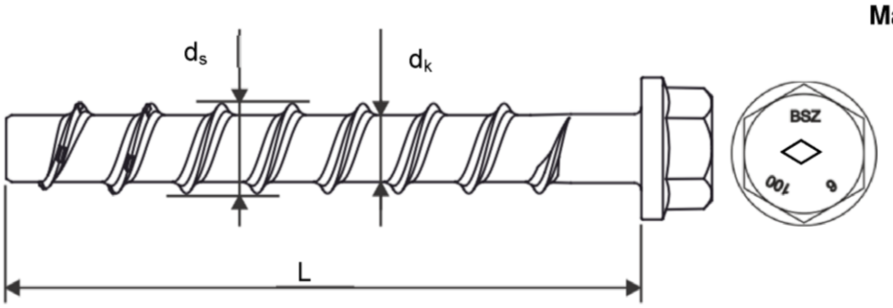
**Screwbolt TSM**

**Product description**
Anchor types and description

**Annex A3**

**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 diameter | $d_s$ | [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 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 A4**

## Intended use

**Anchorages subject to:**
- static and quasi static loads,
- use only for multiple use for non-structural application according to ETAG 001, Part 6
- TSM 6 can also be used for anchorages with requirements related to resistance of fire (not for use in in precast prestressed hollow core slabs)

**Base materials:**
- Reinforced and unreinforced concrete according to EN 206-1:2000-12,
- Strength classes C20/25 to C50/60 according to EN 206-1:2000-12,
- Cracked and uncracked concrete
- TSM 6 can also be used in precast prestressed hollow core slabs

**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 deicing 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 under static or quasi-static actions for multiple use for non-structural applications 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 static or quasi-static actions for precast prestressed hollow core slabs:
  - ETAG 001, Annex C, design method C, Edition August 2010.
- 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)
- 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.
- The design method according to CEN/TS 1992-4 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,
- 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 | |

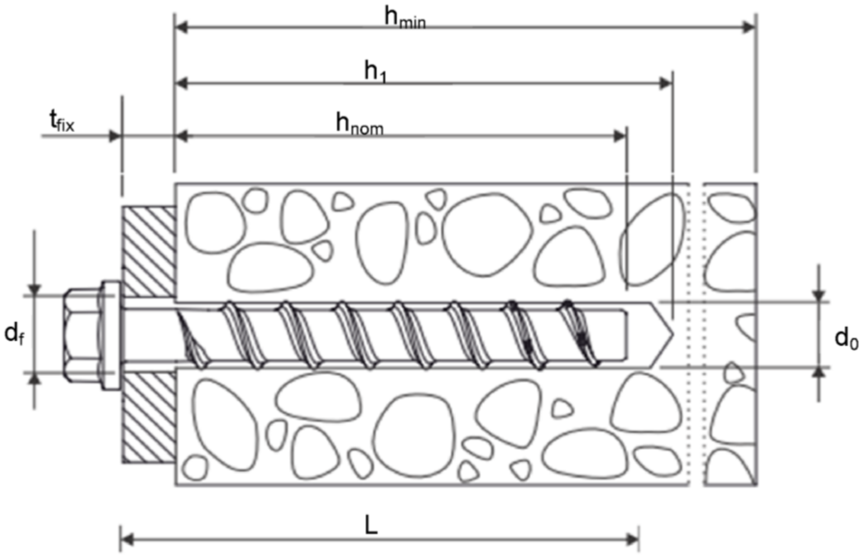
**Table B1: Installation parameters**

| 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 | |
| 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] | 140 | 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 |

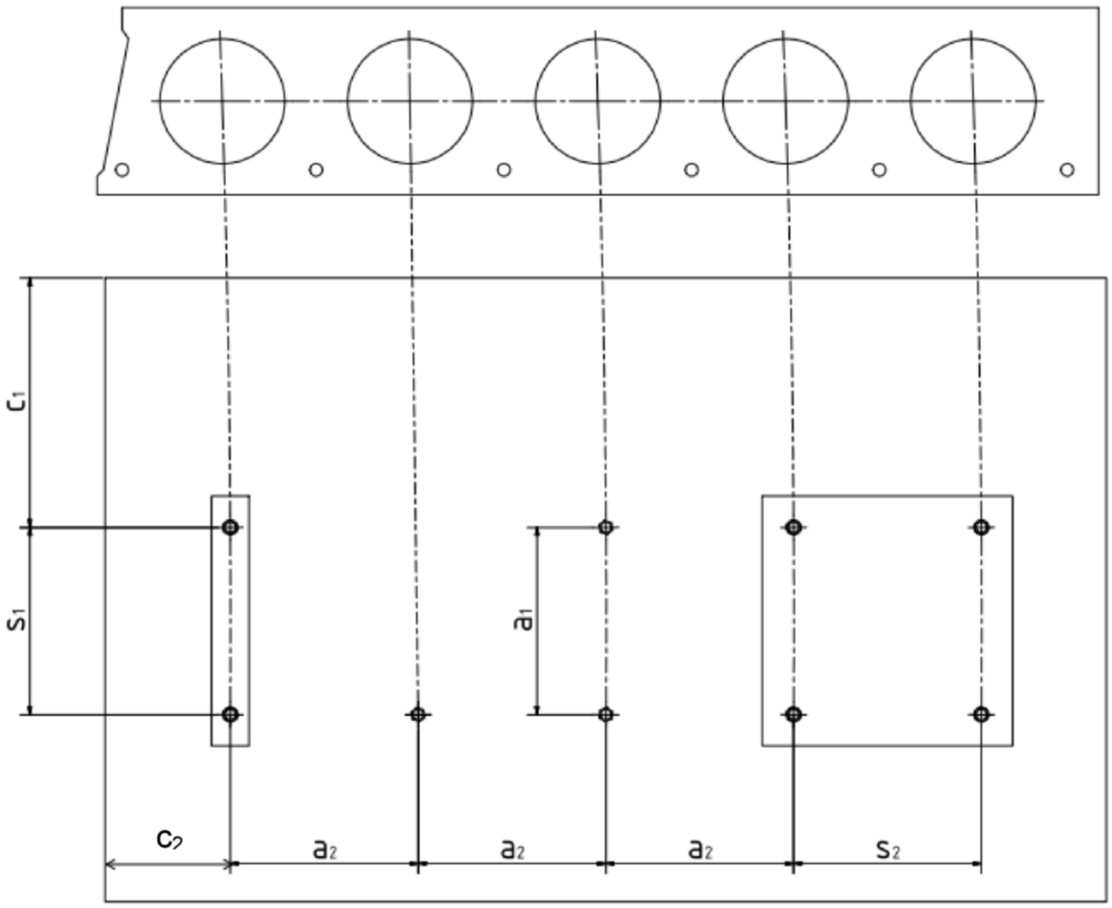



**Screwbolt TSM**

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

**Annex B2**

## Installation parameters for anchorages in precast prestressed hollow core slabs




| | |
|---|---|
| $c_1$, $c_2$ | edge distance |
| $s_1$, $s_2$ | anchor spacing |
| $a_1$, $a_2$ | distance between anchor groups |

| | | |
|---|---|---|
| Minimum edge distance | $c_{min}$ | ≥ 100 mm |
| Minimum anchor spacing | $s_{min}$ | ≥ 100 mm |
| Minimum distance between anchor groups | $a_{min}$ | ≥ 100 mm |

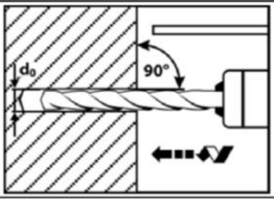
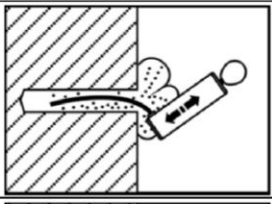
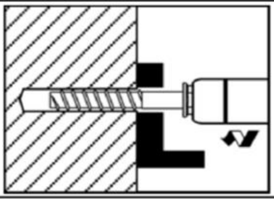
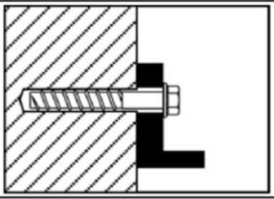


**Screwbolt TSM**

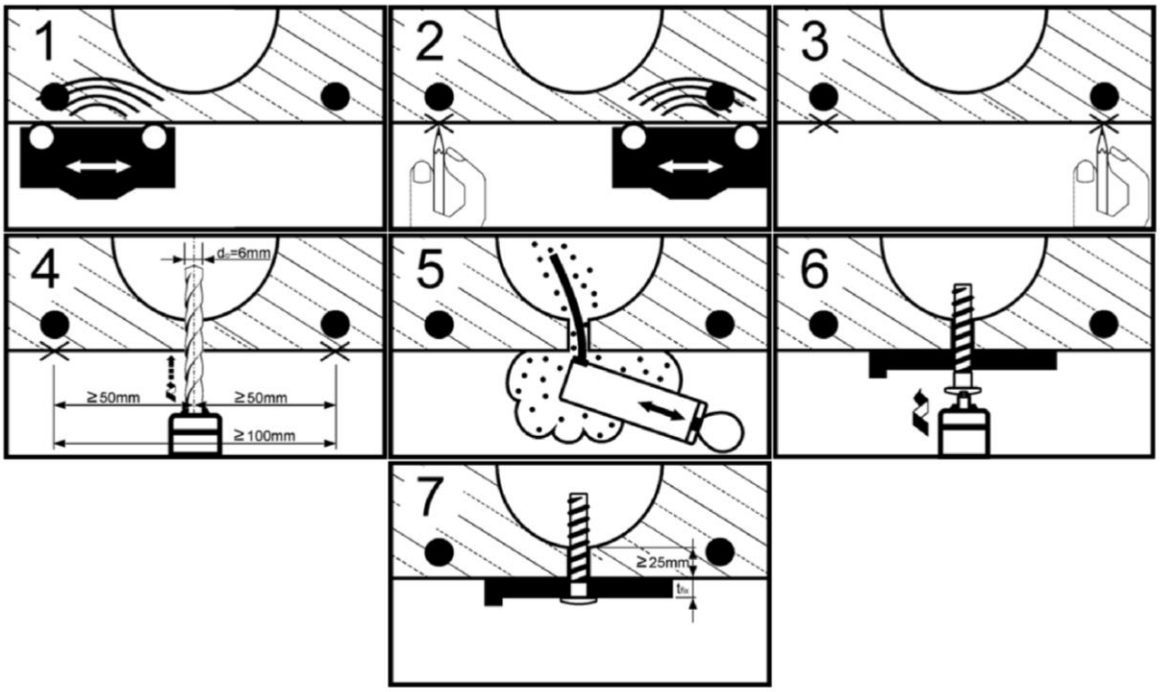
**Intended use**
Installation parameters for anchorages in precast prestressed hollow core slabs

**Annex B3**

## Installation instructions

| | | |
|---|---|---|
| 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. |

## Installation instructions for anchorages in precast prestressed hollow core slabs




**Screwbolt TSM**

**Intended use**
Installation instructions

**Annex B4**

Deutsches Institut für Bautechnik DIBt

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

| **Anchor size** | | | | **TSM 5** | **TSM 6** | |
|---|---|---|---|---|---|---|
| Nominal embedment depth | | $h_{nom}$ | [mm] | 35 | 35 | 55 |
| Installation safety factor | | $\gamma_2 = \gamma_{inst}$ | [-] | 1,2 | 1,2 | 1,0 |
| **Steel failure** | | | | | | |
| Characteristic tension resistance | | $N_{Rk,s}$ | [kN] | 8,7 | 14,0 | |
| **Pull-out** | | | | | | |
| Characteristic resistance in cracked and uncracked concrete C20/25 | | $N_{Rk,p}$ | [kN] | 1,5 | 1,5 | 7,5 |
| Increasing factor for $N_{Rk,p}$ for concrete strength > C20/25 | | $\Psi_C$ | [-] | $\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$ | | |
| **Concrete cone failure** | | | | | | |
| Effective anchorage depth | | $h_{ef}$ | [mm] | 27 | 27 | 44 |
| Spacing (Edge distance) | | $s_{cr,N}$ ($c_{cr,N}$) | [mm] | 3 $h_{ef}$ (1,5 $h_{ef}$) | | |
| Factor for concrete (according CEN/TS 1992-4) | cracked | $k_{cr}$ | [-] | 7,2 | | |
| | uncracked | $k_{ucr}$ | [-] | 10,1 | | |
| **Splitting** | | | | | | |
| Spacing | | $s_{cr,sp}$ | [mm] | 120 | 120 | 160 |
| Edge distance | | $c_{cr,sp}$ | [mm] | 60 | 60 | 80 |

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

| **Anchor size** | | | **TSM 5** | **TSM 6** | |
|---|---|---|---|---|---|
| Nominal embedment depth | $h_{nom}$ | [mm] | 35 | 35 | 55 |
| Installation safety factor | $\gamma_2 = \gamma_{inst}$ | [-] | 1,0 | 1,0 | |
| **Steel failure without lever arm** | | | | | |
| Characteristic shear resistance | $V_{Rk,s}$ | [kN] | 4,4 | 7,0 | |
| Factor of ductility acc. to CEN/TS 1992-4 | $k_2$ | [-] | 0,8 | 0,8 | |
| **Steel failure with lever arm** | | | | | |
| Characteristic bending moment | $M^0_{Rk,s}$ | [Nm] | 5,3 | 10,9 | |
| **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 | |
| **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**

**Annex C1**

**Table C3:** Characteristic values of resistance in **precast prestressed hollow core slabs** C30/37 to C50/60

| **Anchor size** | | | **TSM 6** | | |
|---|---|---|---|---|---|
| Installation safety factor | $\gamma_2 = \gamma_{inst}$ | [-] | 1,2 | | |
| **Flange thickness** | $d_b$ | **[mm]** | **≥ 25** | **≥ 30** | **≥ 35** |
| Characteristic resistance for all directions | $F_{Rk}$ | [kN] | 1 | 2 | 3 |
| Characteristic bending moment | $M^0_{Rk,s}$ | [Nm] | 10,9 | | |
| Edge distance | $c_{cr} = c_{min}$ | [mm] | 100 | | |
| Spacing | $s_{cr} = s_{min}$ | [mm] | 100 | | |



**Screwbolt TSM**

**Performance**
Characteristic values of resistance in **precast prestressed hollow core slabs**

**Annex C2**

## Table C4: Characteristic values of resistance under **fire exposure** [1)]

| Anchor size | | | | TSM 6 | | | |
|---|---|---|---|---|---|---|---|
| | | | | 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 moment | 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 $h_{ef}$ | | | |

[1)] The values are not for use in precast prestressed hollow core slabs

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.



**Screwbolt TSM**

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

**Annex C3**