Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

European Technical Assessment ETA-16/0452 of 14 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	TURBO SMART
Product family to which the construction product belongs	Fasteners for use in concrete for redundant non-structural systems
Manufacturer	pgb - Polska Sp. z o.o. ul. Fryderyka Wilhelma Redena 3 41-807 ZABRZE POLEN
Manufacturing plant	manufacturing plant 3
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-16/0452 issued on 15 July 2016

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Specific Part

1 Technical description of the product

The TURBO SMART concrete screw is an anchor of size 5 and 6 mm made of galvanised steel respectively steel with zinc flake coating and of 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.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable EAD

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 B 2, Annex C 1 and C 2
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1 and 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 14 May 2020 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Tempel

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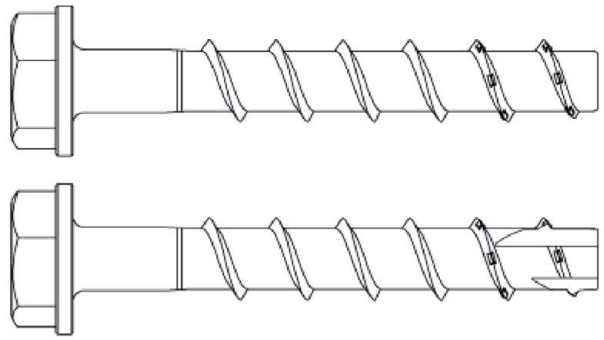
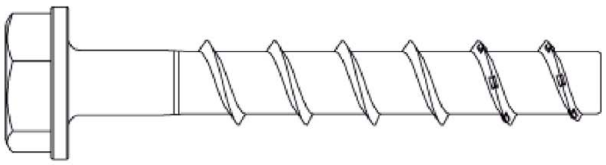
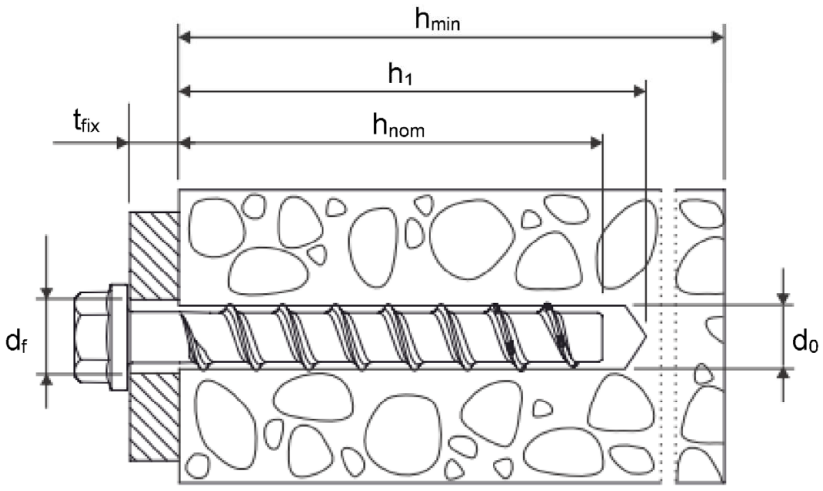
Product in installed condition

TURBO SMART concrete screw

	Carbon steel, zinc-plated and zinc-flake coating
	Stainless steel A4 and HCR



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

TURBO SMART concrete screw

Product description
Installed condition

Annex A1

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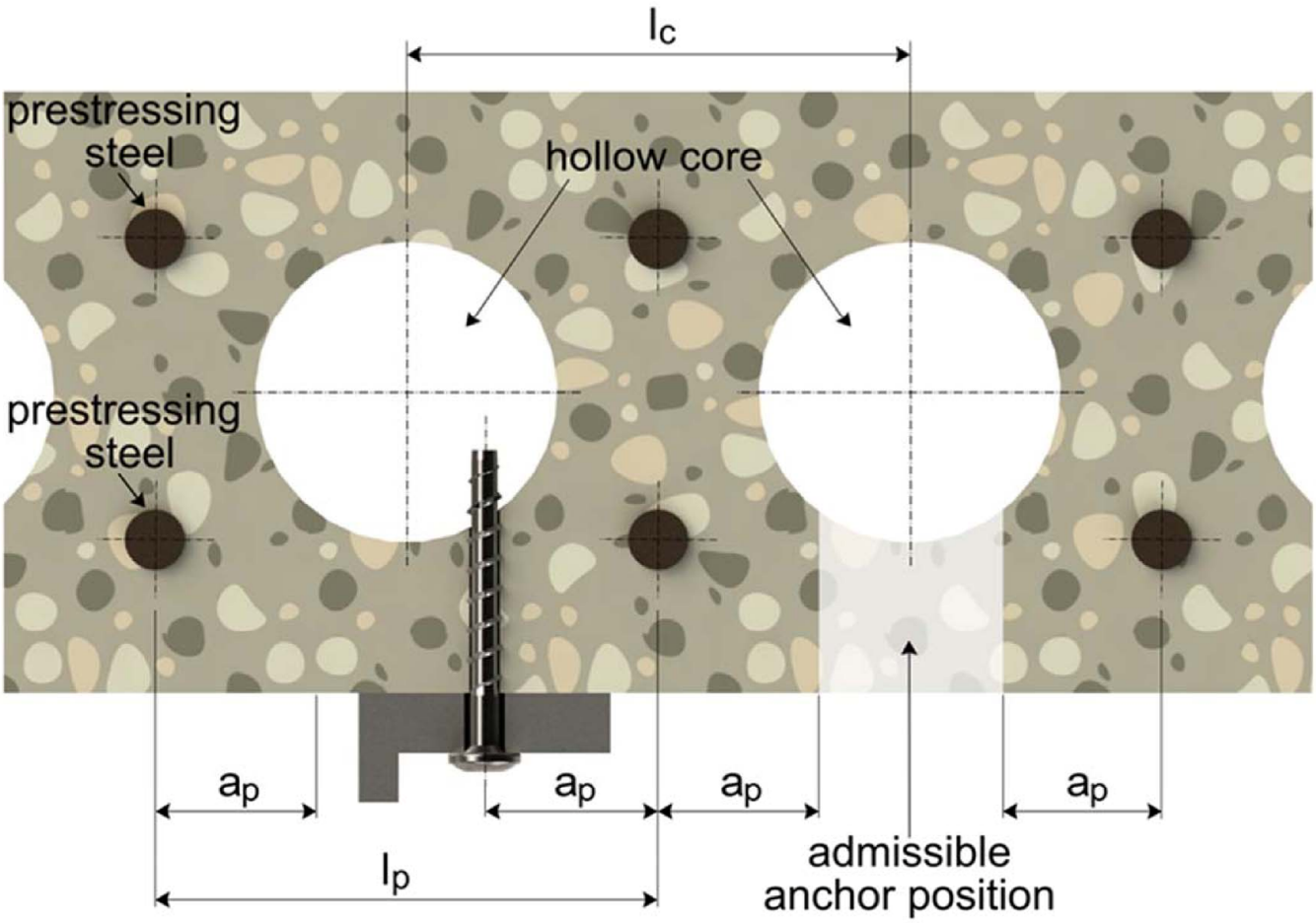
Installed condition in precast prestressed hollow core slabs



Important ratio: $\frac{w}{e} \leq 4,2$

w = core width

e = web thickness

l_c = core distance ≥ 100 mm

l_p = prestressing steel ≥ 100 mm

a_p = distance between anchor position and prestressing steel ≥ 50mm

TURBO SMART concrete screw	Annex A2
Product description Installed condition in precast prestressed hollow core slabs	

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1		TURBO SMART S-BSZ	Concrete screw version with hexagon head with pressed-on washer
2		TURBO SMART S-BSM	Concrete screw version with hexagon head with pressed-on washer and T-drive
3		TURBO SMART S-BSH	Concrete screw version with hexagon head
4		TURBO SMART S-BSV	Concrete screw with countersunk head
5		TURBO SMART S-BSP	Concrete screw with pan head
6		TURBO SMART S-BSF	Concrete screw with large pan head
7		TURBO SMART S-BSE	Concrete screw with countersunk head and connection thread
8		TURBO SMART S-BSB	Concrete screw with hexagonal head and connection thread
9		TURBO SMART S-BSS	Concrete screw with hexagon drive and connection thread
10		TURBO SMART S-BSA	Concrete screw with connection thread and hexagon socket drive
11		TURBO SMART S-BSI	Concrete screw with internal metric thread and hexagon drive

TURBO SMART concrete screw

Product description
Screw types

Annex A3

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Table A1: Material

Part	Name	Type	Material	f_{yk}	f_{uk}
1 2 3 4 5 6 7 8 9 10 11	Concrete screw	TURBO SMART	Steel EN 10263-4:2017, zinc-plated acc. to EN ISO 4042:2018 or zinc flake coating acc. to EN ISO 10683:2018 (≥ 5µm)	560 N/mm²	700 N/mm²
		TURBO SMART A4	1.4401, 1.4404, 1.4571, 1.4578		
		TURBO SMART HCR	1.4529		

f_{yk} = nominal characteristic steel yield strength

f_{uk} = nominal characteristic steel ultimate strength

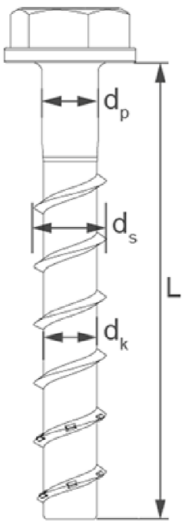
Table A2: Dimensions

Anchor size			5	6
Screw length	≤ L	[mm]	200	
Core diameter	d_k	[mm]	4,0	5,1
Thread outer diameter	d_s	[mm]	6,5	7,5

Marking:
TURBO SMART (Zinc plated and Zinc flake)
Anchor type: TSM
Anchor size: 10
Length of the anchor: 100

TURBO SMART A4
Anchor type: TSM
Anchor size: 10
Length of the anchor: 100
Material: A4

TURBO SMART HCR
Anchor type: TSM
Anchor size: 10
Length of the anchor: 100
Material: HCR



Marking "k" or "x" for anchors with connection thread and h_{nom} = 35 mm

TURBO SMART concrete screw

Product description
Material, Dimensions and markings

Annex A4

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Specification of Intended use

Anchorages subject to:

- static and quasi static loads
- Used only for multiple use for non-structural application according to EN 1992-4:2018
- Used for anchorages with requirements related to resistance of fire (not for using in prestressed hollow core slabs): size 6
- Used for anchorages in prestressed hollow core slabs: size 6

Base materials:

- Reinforced and unreinforced concrete without fibers according to EN 206:2013.
- Strength classes C20/25 to C50/60 according to EN 206:2013.
- Cracked and uncracked concrete.

Use conditions (Environmental conditions):

- Concrete screws subject to dry internal conditions: all screw types.
- Structural subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition no particular aggressive conditions exits: screw types made of stainless steel with marking A4.
- Structural subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition if particular aggressive conditions exits: screw types made of stainless steel with marking HCR.
  Note: Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

Design:

- Anchorages are to be designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are to be 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.
- The design for shear load according to EN 1992-4:2018, Section 6.2.2 applies for all specified diameters d_f of clearance hole in the fixture in Annex B2, Table 3.

Installation:

- Hammer drilling or hollow drilling.
- Anchor installation carried out by appropriately qualified personal and under the supervision of the person responsible for technical matters on site.
- In case of aborted hole: new drilling must be drilled at a minimum distance of twice the depth of aborted hole or closer, if the aborted hole is filled with high strength mortar and only if the hole is not in the direction of the oblique tensile or shear load.
- After installation further turning of the anchor must not be possible. The head of the anchor is supported in the fixture and is not damaged.

TURBO SMART concrete screw	
Intended use Specification	**Annex B1**

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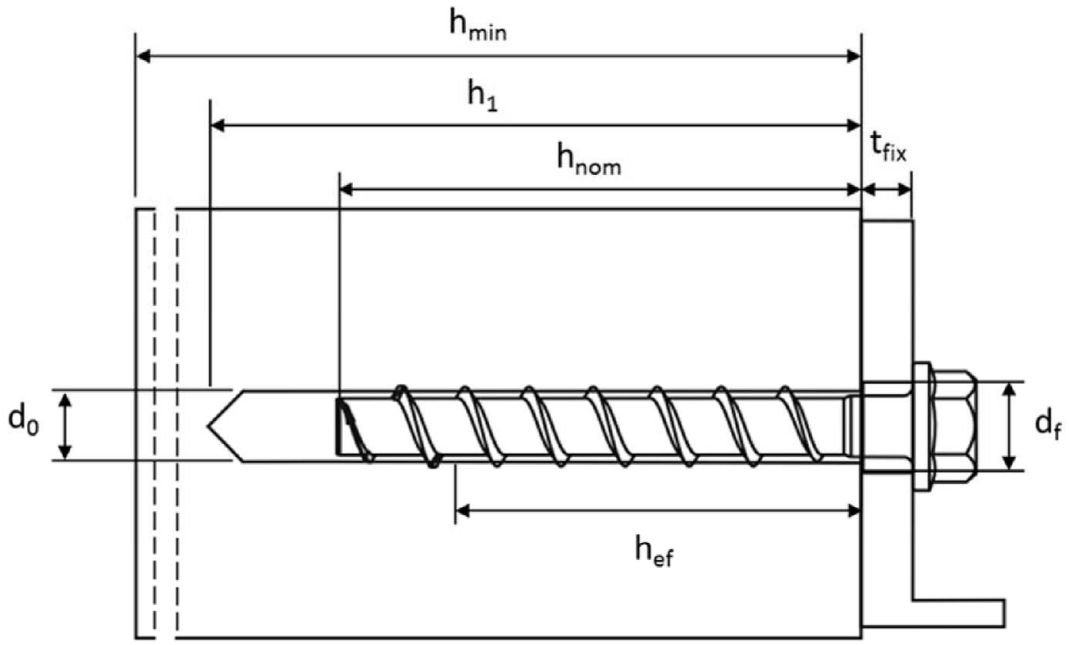
Table B1: Installation parameters

TURBO SMART concrete screw size			5	6	
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}
		[mm]	35	35	55
Nominal drill hole diameter	d_0	[mm]	5	6	
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	5,40	6,40	
Drill hole depth	$h_1 \geq$	[mm]	40	40	60
Clearance hole diameter	$d_f \leq$	[mm]	7	8	
Installation torque (version with connection thread)	$T_{inst} \leq$	[Nm]	8	10	
Recommended torque for impact screw driver		[Nm]	Max. torque according to manufacturer's instructions		
			110	160	

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

TURBO SMART concrete screw size			5	6	
Nominal embedment depth		h_{nom1}	h_{nom1}	h_{nom1}	h_{nom2}
		[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



TURBO SMART concrete screw

Intended use
Installation parameters

Annex B2

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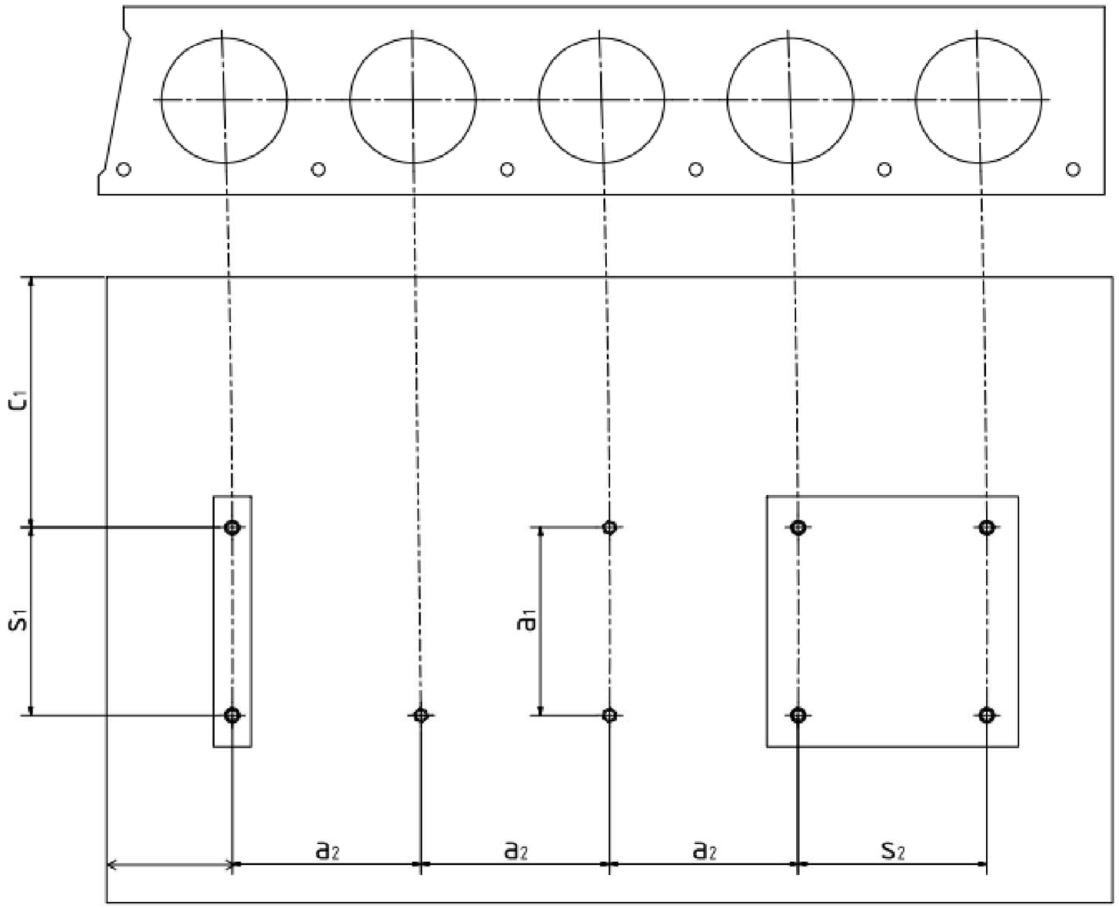
Installation parameters for anchorages in precast prestressed hollow core slabs



c_1, c_2 = edge distance

s_1, s_2 = anchor spacing

a_1, a_2 = distance between anchor groups

c_{min} = minimum edge distance ≥ 100 mm

s_{min} = minimum anchor spacing ≥ 100 mm

a_{min} = minimum distance between anchor groups ≥ 100 mm

TURBO SMART concrete screw

Intended use
Installation parameters for anchorages in prestressed hollow slabs

Annex B3

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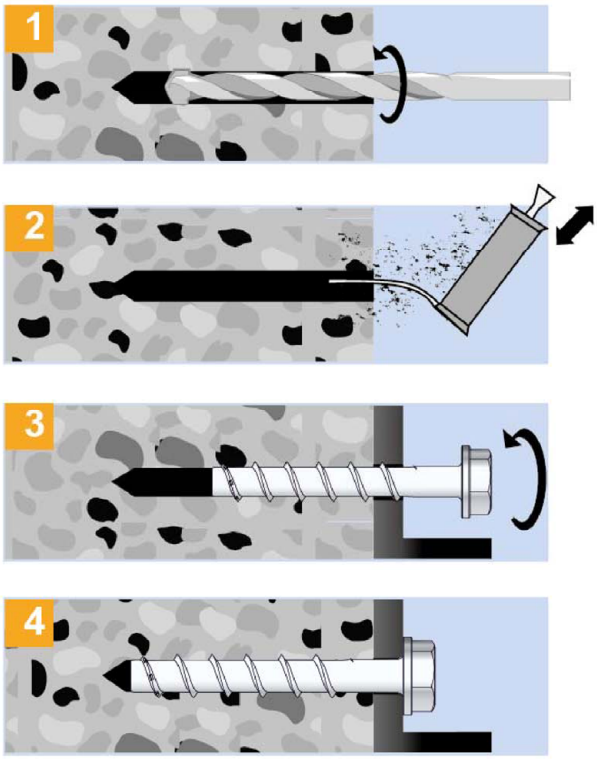
Installation instructions



1. **Drilling:**
   Create hammer drilled or hollow drilled borehole.

2. **Cleaning of the drill hole**:
   Remove drill dust by vacuuming or blowing.

3. **Installation:**
   Install the anchor by impact screwdriver or torque wrench.

4. **Complete:**
   Verify that the head is pressed to the fixture.

Remark: cleaning of borehole is not necessary when using an hollow drill bit

TURBO SMART concrete screw	
Intended use Installation instructions	**Annex B4**

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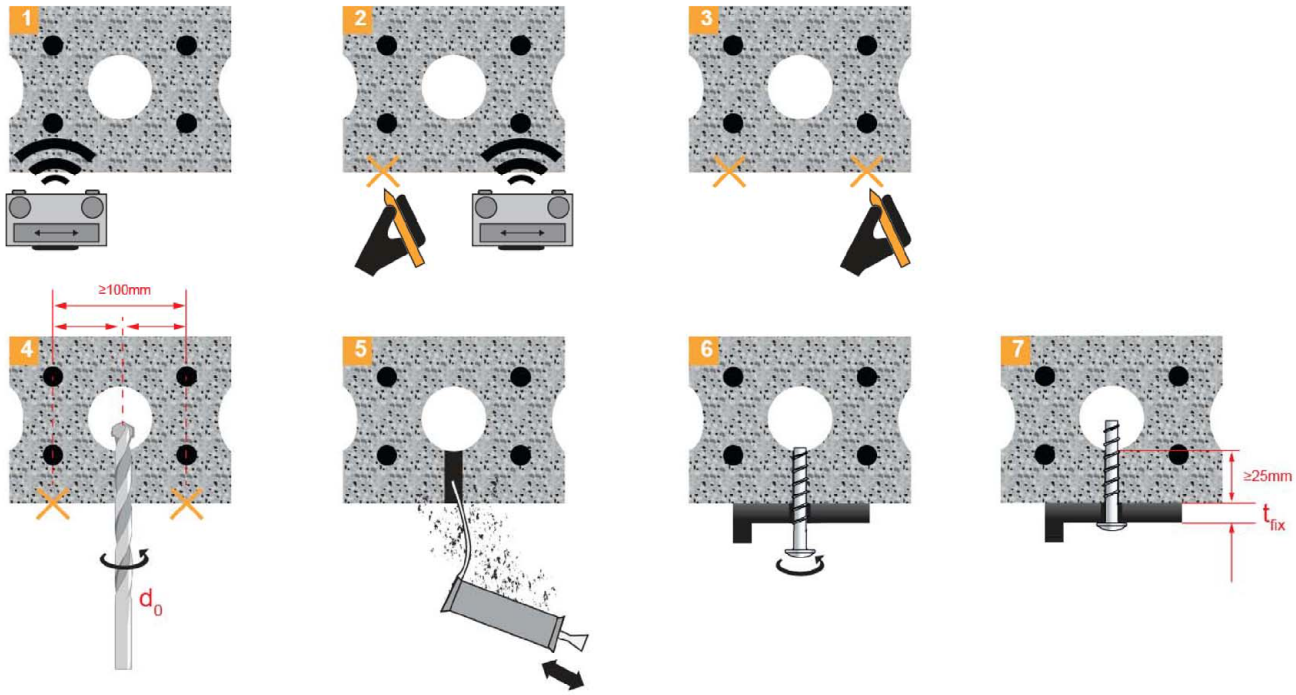
Installation instructions for anchorages in prestressed hollow core slabs



TURBO SMART concrete screw

Intended use
Installation instructions for anchorages in prestressed hollow slabs

Annex B5

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Table C1: Characteristic values for static and quasi-static loading

TURBO SMART concrete screw size				5	6	
Nominal embedment depth			h_{nom}	h_{nom1}	h_{nom1}	h_{nom2}
			[mm]	35	35	55
Steel failure for tension and shear loading						
Characteristic tension load		$N_{Rk,s}$	[kN]	8,7	14,0	
Partial factor tension load		$\gamma_{Ms,N}$	[-]	1,5		
Characteristic shear load		$V_{Rk,s}$	[kN]	4,4	7,0	
Partial factor shear load		$\gamma_{Ms,V}$	[-]	1,25		
Ductility factor		k_7	[-]	0,8		
Characteristic bending load		$M^0_{Rk,s}$	[Nm]	5,3	10,9	
Pull-out failure						
Characteristic tension load C20/25	cracked	$N_{Rk,p}$	[kN]	1,5	3,0	7,5
	uncracked	$N_{Rk,p}$	[kN]	1,5	3,0	7,5
Increasing factor for $N_{Rk,p}$	C20/25	Ψ_c	[-]	1,12		
	C30/37			1,22		
	C40/50			1,41		
	C50/60			1,58		
Concrete failure: Splitting failure, concrete cone failure and pry-out failure						
Effective embedment depth		h_{ef}	[mm]	27	27	44
k-factor	cracked	$k_1 = k_{cr}$	[-]	7,7		
	uncracked	$k_1 = k_{ucr}$	[-]	11,0		
Concrete cone failure	spacing	$s_{cr,N}$	[mm]	3 x h_{ef}		
	edge distance	$c_{cr,N}$	[mm]	1,5 x h_{ef}		
Splitting failure	Char. resistance	$N^0_{Rk,Sp}$	[kN]	min($N^0_{Rk,c}$; $N_{Rk,p}$)		
	spacing	$s_{cr,Sp}$	[mm]	120	120	160
	edge distance	$c_{cr,Sp}$	[mm]	60	60	80
Factor for pry-out failure		k_8	[-]	1,0		
Installation factor		γ_{inst}	[-]	1,2	1,0	1,0
Concrete edge failure						
Effective length in concrete		$l_f = h_{ef}$	[mm]	27	27	44
Nominal outer diameter of screw		d_{nom}	[mm]	5	6	

TURBO SMART concrete screw

Performances
Characteristic values for static and quasi-static loading

Annex C1

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Table C2: Characteristic values for resistance in prestressed hollow core slabs C30/37 to C50/60

TURBO SMART concrete screw size			6		
Bottom flange thickness	d_b	[mm]	≥ 25	≥ 30	≥ 35
Characteristic resistance	F^0_{Rk}	[kN]	1	2	3
Edge distance	c_{cr}	[mm]	100		
Spacing	s_{cr}	[mm]	200		
Installation factor	γ_{inst}	[-]	1,0		

Table C3: Limiting distances for application in prestressed hollow core slabs

Distances for application in precast prestressed hollow core slabs			
Minimum edge distance	c_{min}	[mm]	≥ 100
Minimum anchor spacing	s_{min}	[mm]	≥ 100
Minimum distance between anchor groups	a_{min}	[mm]	≥ 100
Distance of core	l_c	[mm]	≥ 100
Distance of prestressing steel	l_p	[mm]	≥ 100
Distance between anchor position and prestressing steel	a_p	[mm]	≥ 50

TURBO SMART concrete screw

Performances
Characteristic values and limiting distances in prestressed hollow core slabs

Annex C2

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Table C4: Fire exposure – characteristic values of resistance [1)]

TURBO SMART concrete screw size				6			
Material				Steel		Stainless steel A4/HCR	
Nominal embedment depth			h_{nom}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}
			[mm]	35	55	35	55
Steel failure for tension and shear load ($F_{Rk,s,fi} = N_{Rk,s,fi} = V_{Rk,s,fi}$)							
Characteristic Resistance	R30	$F_{Rk,s,fi30}$	[kN]	0,9		1,2	
	R60	$F_{Rk,s,fi60}$	[kN]	0,8		1,2	
	R90	$F_{Rk,s,fi90}$	[kN]	0,6		1,2	
	R120	$F_{Rk,s,fi120}$	[kN]	0,4		0,8	
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,7		0,9	
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,6		0,9	
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,5		0,9	
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,3		0,6	
Pull-out failure							
Characteristic Resistance	R30-R90	$N_{Rk,p,fi}$	[kN]	0,75	1,875	0,75	1,875
	R120	$N_{Rk,p,fi}$	[kN]	0,6	1,5	0,6	1,5
Concrete cone failure							
Characteristic Resistance	R30-R90	$N^0_{Rk,c,fi}$	[kN]	0,86	2,76	0,86	2,76
	R120	$N^0_{Rk,c,fi}$	[kN]	0,68	2,21	0,68	2,21
Edge distance							
R30 - R120		$c_{cr,fi}$	[mm]	$2 \times h_{ef}$			
In case of fire attack from more than one side, the minimum edge distance shall be ≥300mm.							
Spacing							
R30 - R120		$s_{cr,fi}$	[mm]	$4 \times h_{ef}$			
Pry-out failure							
R30 - R120		k_8	[-]	1,0			
The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value.							

1) Not for application in prestressed hollow core slabs

TURBO SMART concrete screw

Performances
Characteristic values under fire exposure

Annex C3