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-21/0425 of 23 February 2022

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	TOGE concrete screw TSM high performance LT
Product family to which the construction product belongs	Mechanical fasteners for use in concrete
Manufacturer	TOGE Dübel GmbH & Co. KG Illesheimer Straße 10 90431 Nürnberg DEUTSCHLAND
Manufacturing plant	TOGE plant
This European Technical Assessment contains	19 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 330232-01-0601, Edition 05/2021

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Specific Part

1 Technical description of the product

The TOGE concrete screw TSM high performance LT is an anchor in size 6, 8 and 10 mm made 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.

Product and product description are 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 resistance to tension load (static and quasi-static loading)	See Annex B4, C1 and C2
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C1 and C2
Displacements (static and quasi-static loading)	See Annex C5
Characteristic resistance and displacements for seismic performance categorie C1	See Annex C3
Durability	See Annex B1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C4

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. 330232-01-0601 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 23 February 2022 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

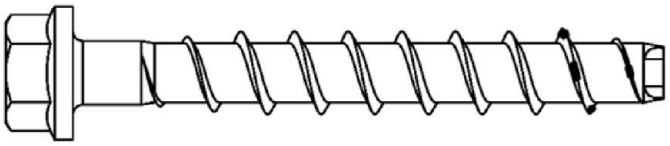
beglaubigt:
Tempel

Deutsches Institut für Bautechnik DIBt

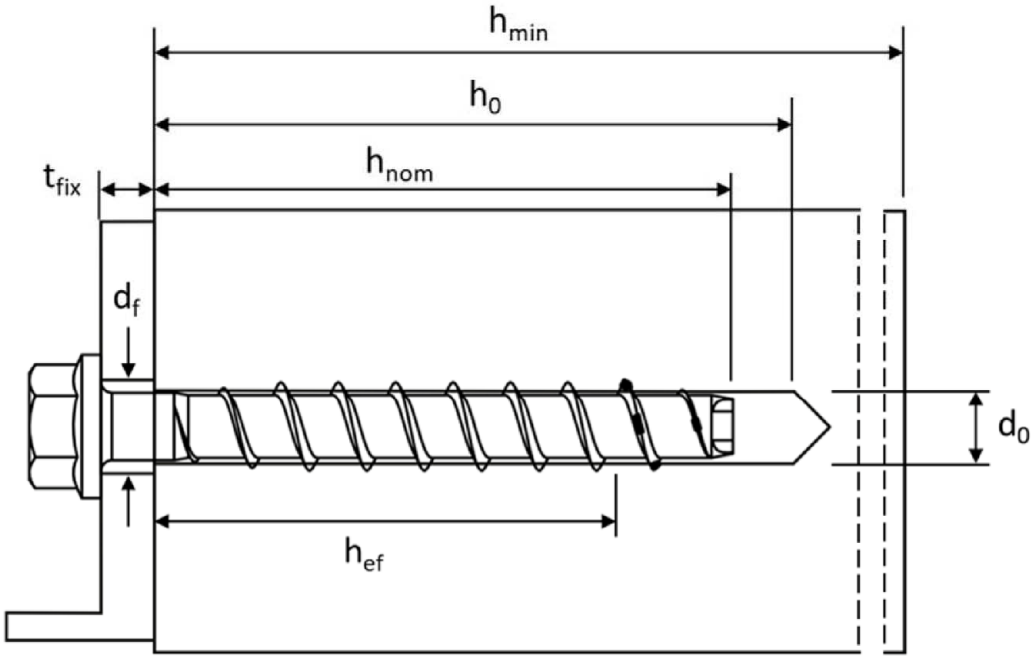
Product in installed condition

TOGE concrete screw TSM high performance LT

- stainless steel A4
- high corrosion resistant steel HCR



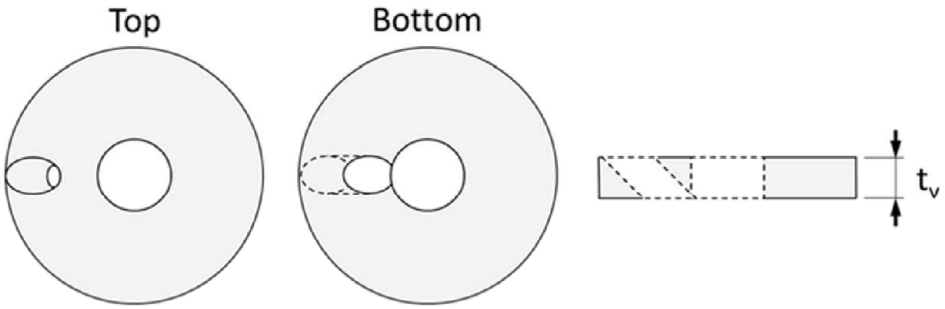
e.g. TOGE concrete screw with hexagon head and fixture



d_0 = nominal diameter of drill hole
t_{fix} = thickness of fixture
d_f = diameter of clearance hole

h_{min} = minimum thickness of member
h_{nom} = nominal embedment depth
h_0 = depth of drill hole
h_{ef} = effective embedment depth

Filling washer (optional) to fill annular gap



TOGE concrete screw TSM high performance LT	**Annex A1**
Product description Product in installed condition	

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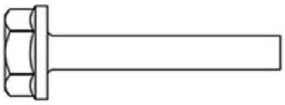
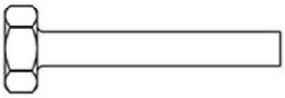
Version with metric connection thread
and hexagon drive e.g. TSM 8x105 M10 SW7; Type ST


Version with washer and hexagon head
e.g. TSM 8x80 SW13 VZ 40; Type S

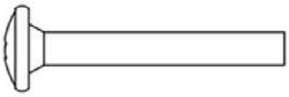



Version with washer, hexagon head and
TORX drive e.g. TSM 8x80 SW13; Type S

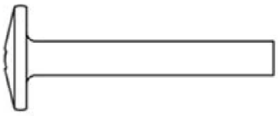



Version with hexagon head
e.g. TSM 8x80 SW13 OS; Type S

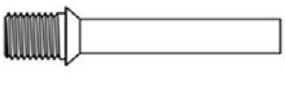

Version with countersunk head and TORX drive e.g.
TSM 8x80 C VZ 40; Type SK



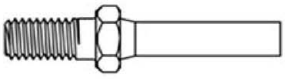

Version with pan head and TORX
drive e.g. TSM 8x80 P VZ 40; Type P



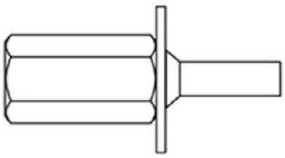

Version with large pan head and TORX
drive e.g. TSM 8x80 LP VZ 40; Type P



Version with countersunk head and
connection thread e.g. TSM 6x55 AG M8; Type ST-6




Version with hexagon drive and
connection thread e.g. TSM 6x55 M8 SW10; Type ST-6




Version with internal thread and
hexagon drive e.g. TSM 6x55 IM M8/10; Type I

TOGE concrete screw TSM high performance LT

Product description
Screw types

Annex A2

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Table 1: Material

Part	Product name	Material
all types	TSM LT A4	1.4401; 1.4404; 1.4571; 1.4578
	TSM LT HCR	1.4529

Part	Product name	Nominal characteristic steel		Rupture elongation
		Yield strength f_{yk} [N/mm²]	Ultimate strength f_{uk} [N/mm²]	A_5 [%]
all types	TSM LT A4	560	700	≤ 8
	TSM LT HCR			

Table 2: Dimensions

Anchor size			6			8			10		
Nominal embedment depth		h_{nom}	1[1)]	2	3	1	2	3	1	2	3
		[mm]	35	45	55	45	55	65	55	75	85
Screw length	≤ L	[mm]	500								
Core diameter	d_K	[mm]	5,1			7,2			9,2		
Thread outer diameter	d_s	[mm]	7,6			10,5			12,5		
Thickness of filling washer	t_v	[mm]	-			5			5		

1) only for statically indeterminate non-structural systems (multiple use) according to EN 1992-4:2018, only in dry internal conditions

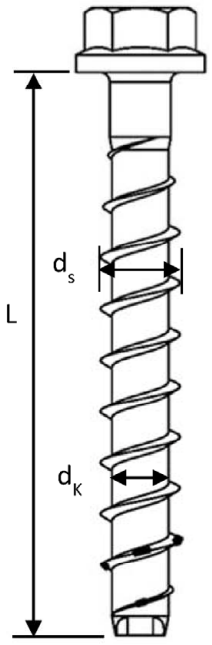
Marking:

TSM high performance LT A4

Screw type:	TSM LT
Screw size:	10
Screw length:	100
Material:	A4

TSM high performance LT HCR

Screw type:	TSM LT
Screw size:	10
Screw length:	100
Material:	HCR



TOGE concrete screw TSM high performance LT

Product description
Material, dimensions and markings

Annex A3

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Specification of Intended use

Table 3: Anchorages subject to

TSM concrete screw size		6			8			10		
Nominal embedment depth	h_{nom}	h_{nom1} [1)]	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
	[mm]	35	45	55	45	55	65	55	75	85
Static and quasi-static loads		All sizes and all embedment depths								
Fire exposure										
C1 category - seismic		x	ok	ok	ok	x	ok	ok	x	ok

[1)] only for statically indeterminate non-structural systems (multiple use) according to EN 1992-4:2018, only in dry internal conditions

x no performance assessed

Base materials:

- Compacted 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.
- For all other conditions corresponding to corrosion resistance classes CRC according to EN 1993-1-4:2006 + A1:2015
  - Stainless steel according to Annex A3, screw with marking A4: CRC III
  - High corrosion resistant steel according to Annex A3, screw with marking HCR: CRC V

TOGE concrete screw TSM high performance LT	Annex B1
Intended use Specification	

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Specification of Intended use - continuation

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, Edition February 2018.

  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 B3, Table 4.

Installation:

- Hammer drilling or hollow drilling. Hollow drilling only for size 8-10.
- Anchor installation carried out by appropriately qualified personnel 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.
- The borehole may be filled with injection mortar CF-T 300V or ATA 2004C.
- Adjustability according to Annex B6 for sizes 6-10 except for applications with filled borehole and not for seismic applications.
- Cleaning of borehole is not necessary, if using a hollow drill.

TOGE concrete screw TSM high performance LT	Annex B2
Intended use Specification continuation	

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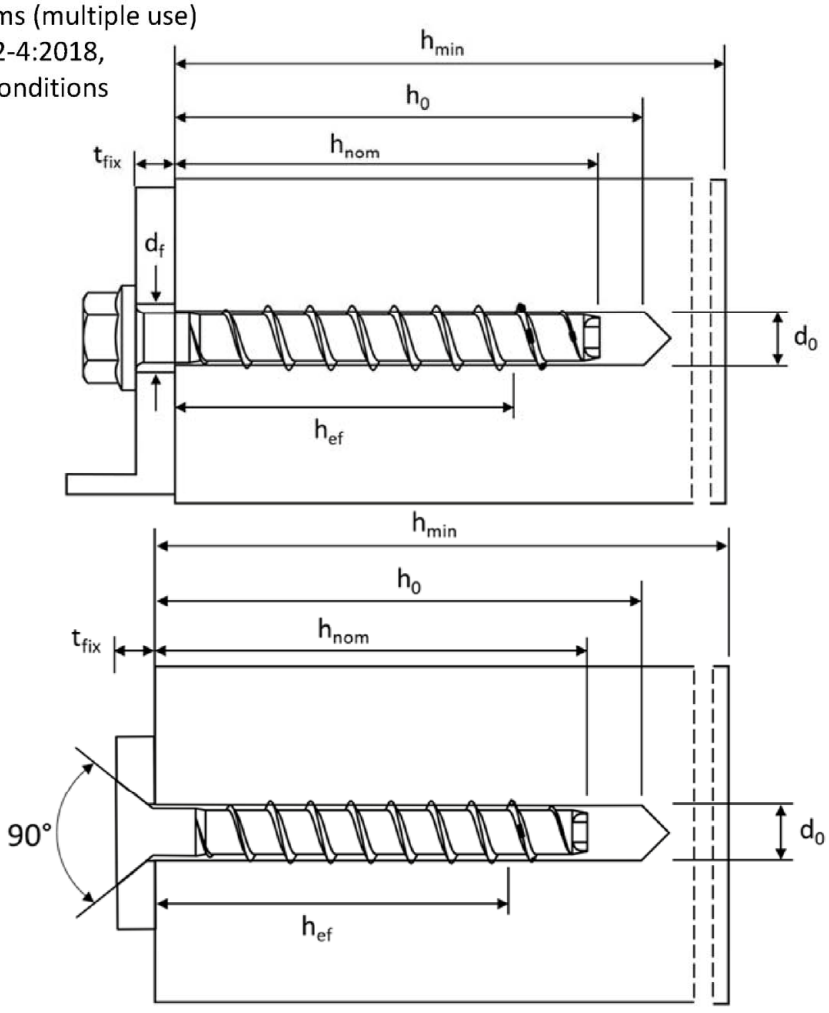
Table 4: Installation parameters

TSM concrete screw size			6			8			10		
Nominal embedment depth		h_{nom}	h_{nom1} [1)]	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		[mm]	35	45	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]	6,40			8,45			10,45		
Depth of drill hole	$h_0 \geq$	[mm]	40	50	60	55	65	75	65	85	95
Clearance hole diameter	$d_f \leq$	[mm]	8			12			14		
Installation torque (version with connection thread)	T_{inst}	[Nm]	10			20			40		
Torque impact screw driver		[-]	Max. torque according to manufacturer's instructions								
			160			300			450		

[1)] only for statically indeterminate non-structural systems (multiple use) according to EN 1992-4:2018, only in dry internal conditions



TOGE concrete screw TSM high performance LT

Intended use
Installation parameters

Annex B3

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Table 5: Minimum thickness of member, minimum edge distance and minimum spacing

TSM concrete screw size			6			8			10		
Nominal embedment depth		h_{nom}	h_{nom1} [1)]	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		[mm]	35	45	55	45	55	65	55	75	85
Minimum thickness of member	h_{min}	[mm]	80	80	100	80	100	120	100	130	130
Minimum edge distance	c_{min}	[mm]	35	35	35	35	35	35	40	40	40
Minimum spacing	s_{min}	[mm]	35	35	35	35	35	35	40	40	40

[1)] only for statically indeterminate non-structural systems (multiple use) according to EN 1992-4:2018, only in dry internal conditions

TOGE concrete screw TSM high performance LT

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

Annex B4

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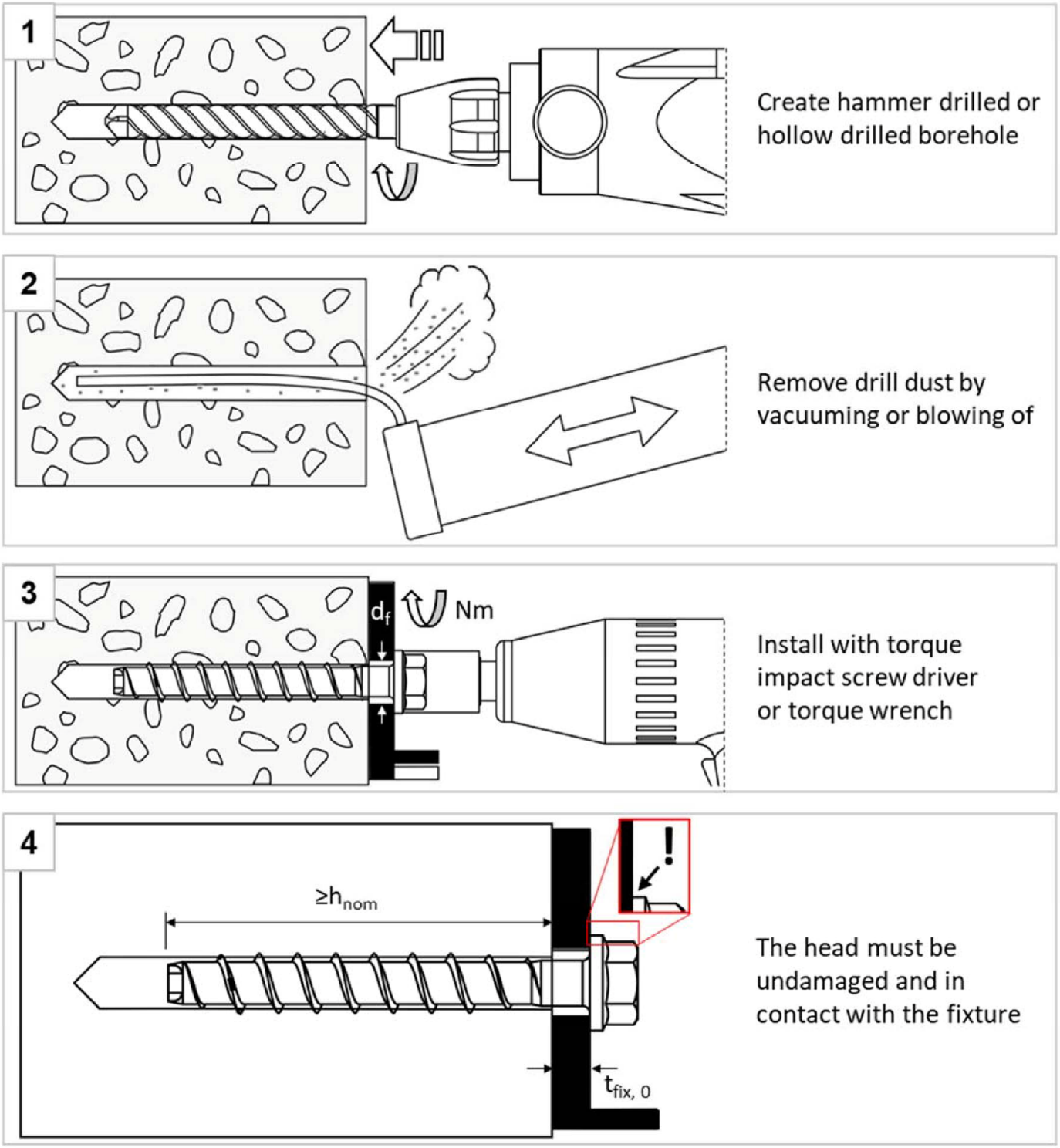
Installation Instructions



For screw size 6 with h_{nom} = 35mm, installation only with impact screw drivers.

TOGE concrete screw TSM high performance LT	**Annex B5**
Intended use Installation instructions	

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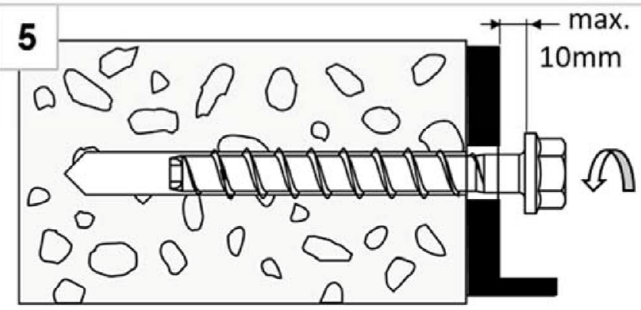
Installation Instructions – Adjustment

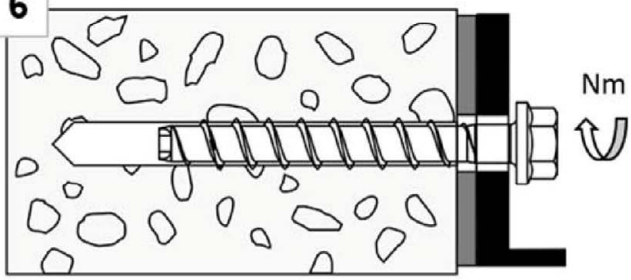
1. Adjustment

5



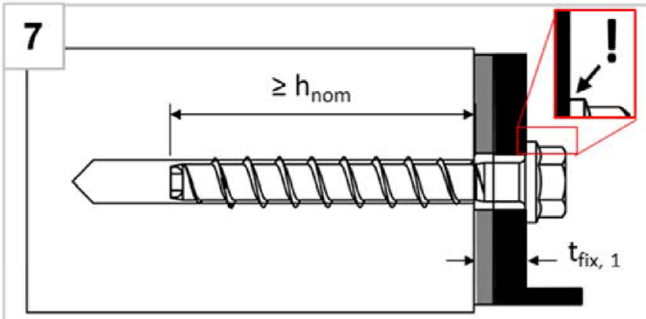
Screw may be untightened maximum 10mm

6



After adjustment, tighten the screw again

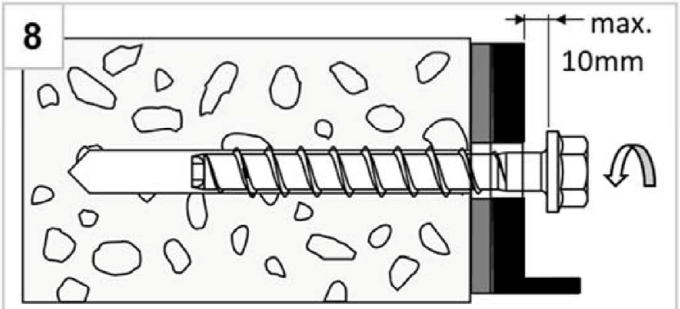
7



The head must be undamaged and in contact with the fixture

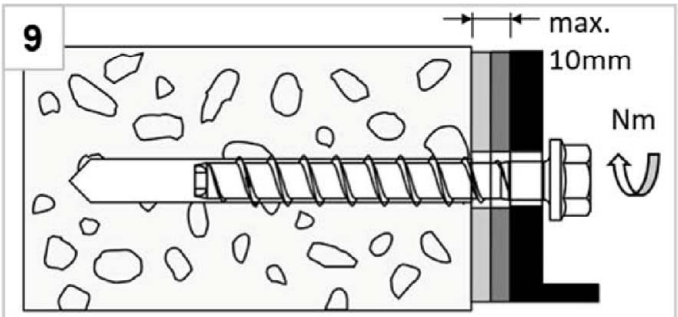
2. Adjustment

8



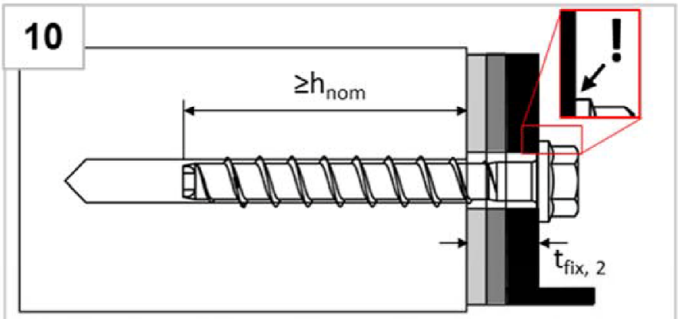
Screw may be untightened maximum 10mm

9



After adjustment, tighten the screw again

10



The head must be undamaged and in contact with the fixture

Note:
The fastener can be adjusted maximum two times. The total allowed thickness of shims added during the adjustment process is 10mm. The final embedment depth after adjustment process must be larger or equal than h_{nom}.

TOGE concrete screw TSM high performance LT	**Annex B6**
Intended use Installation instructions - Adjustment	

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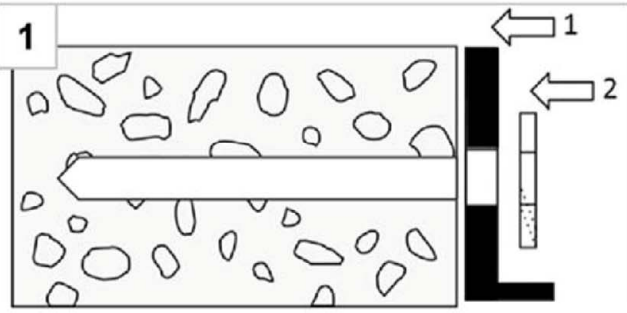
Installation Instructions – Filling annular gap

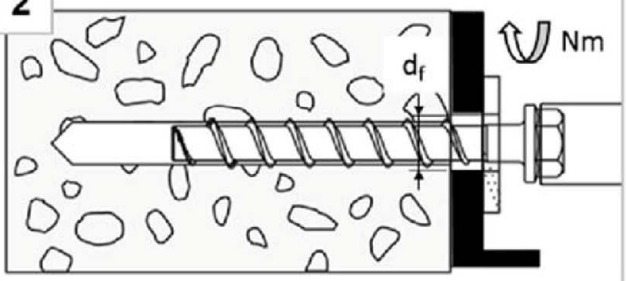
Positioning of fixture and filling washer

1



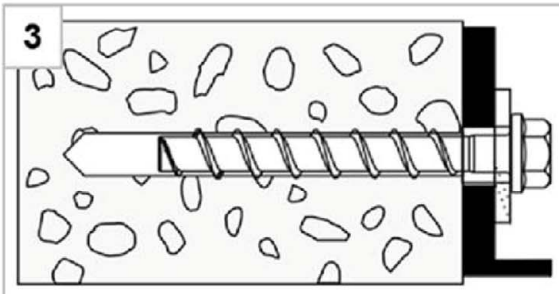
After preparing borehole (Annex B5, figure 1+2), position first fixture (1), than filling washer (2)

2



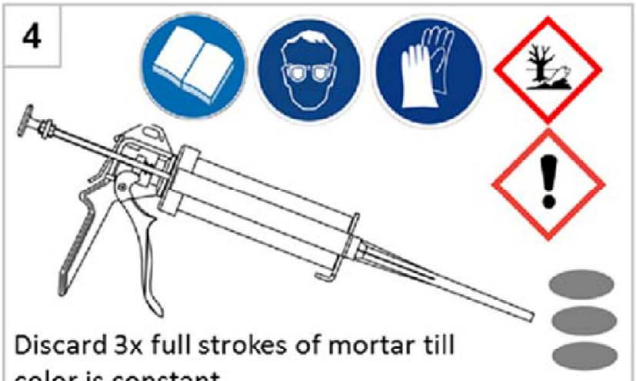
Install with torque impact screw driver or torque wrench

3



Installed condition without injected mortar in the filling washer

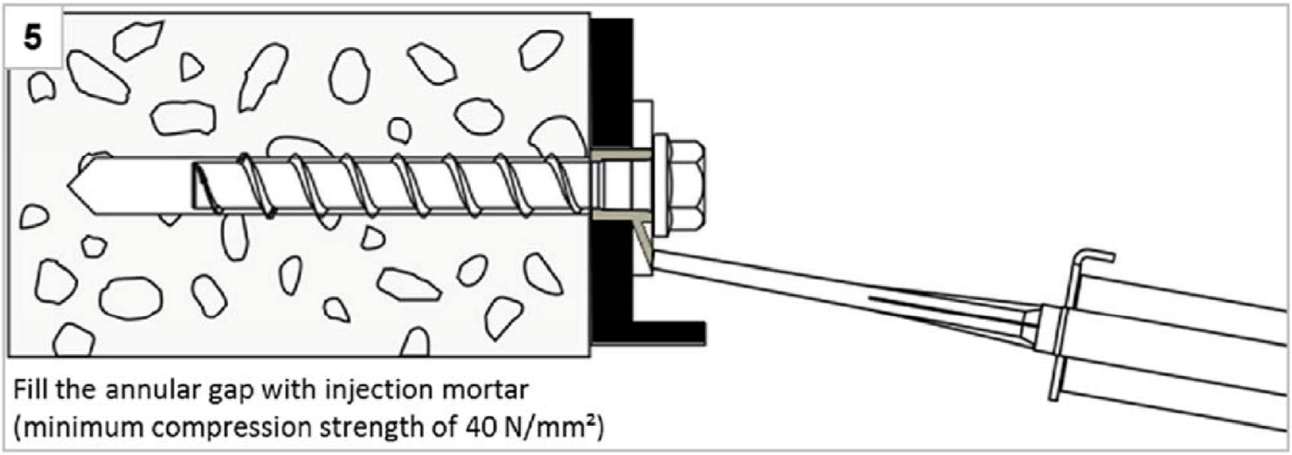
4



Discard 3x full strokes of mortar till color is constant

Filling the annular gap

5



Fill the annular gap with injection mortar (minimum compression strength of 40 N/mm²)

Note:
For seismic loading the installation with filled and without filled annular gap is approved. Differences in performance can be found in Annex C3.

TOGE concrete screw TSM high performance LT	**Annex B7**
Intended use Installation instructions – Filling annular gap	

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Table 6: Characteristic values for static and quasi-static loading

TSM concrete screw size				6			8			10		
Nominal embedment depth			h_{nom}	h_{nom1} [1)]	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
			[mm]	35	45	55	45	55	65	55	75	85
Steel failure for tension and shear loading												
Characteristic tension load		$N_{Rk,s}$	[kN]	14,0			27,0			45,0		
Partial factor		$\gamma_{Ms,N}$	[-]	1,5								
Characteristic shear load		$V^0_{Rk,s}$	[kN]	7,0			13,5		17,0	22,5	34,0	
Partial factor		$\gamma_{Ms,V}$	[-]	1,25								
Ductility factor		k_7	[-]	0,8								
Characteristic bending load		$M^0_{Rk,s}$	[Nm]	10,9			26,0			56,0		
Pull-out failure in uncracked concrete												
Characteristic tension load C20/25		$N_{Rk,p}$	[kN]	3,5	4,0	8,5	9,0	12,0	17,0	11,0	19,0	25,0
Increasing factor for $N_{Rk,p} = N_{Rk,p\ (C20/25)} \cdot \Psi_c$	C25/30	Ψ_c	[-]	1,08	1,22	1,17	1,22		1,13	1,22		
	C30/37			1,15	1,36	1,26	1,36		1,20	1,36		
	C40/50			1,27	1,41	1,30	1,41		1,23	1,41		
	C50/60			1,38	1,58	1,42	1,58		1,32	1,58		
Pull-out failure in cracked concrete												
Characteristic tension load C20/25		$N_{Rk,p}$	[kN]	2,5	1,5	3,0	3,0	5,5	8,0	6,0	13,0	17,0
Increasing factor for $N_{Rk,p} = N_{Rk,p\ (C20/25)} \cdot \Psi_c$	C25/30	Ψ_c	[-]	1,09	1,08	1,22	1,22			1,22	1,17	
	C30/37			1,18	1,15	1,36	1,36			1,36	1,27	
	C40/50			1,32	1,27	1,41	1,41			1,41	1,31	
	C50/60			1,45	1,38	1,58	1,58			1,58	1,43	

[1)] only for statically indeterminate non-structural systems (multiple use) according to EN 1992-4:2018, only in dry internal conditions

TOGE concrete screw TSM high performance LT

Performances
Characteristic values for static and quasi-static loading

Annex C1

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Table 7: Characteristic values for static and quasi-static loading continuation

TSM concrete screw size				6			8			10		
Nominal embedment depth			h_{nom}	h_{nom1} [1)]	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
			[mm]	35	45	55	45	55	65	55	75	85
Concrete failure: concrete cone failure and splitting failure												
Effective embedment depth		h_{ef}	[mm]	25	34	42	32	41	49	40	57	65
k-factor	cracked	k_{cr}	[-]	7,7								
	uncracked	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 case 1	resistance	$N^0_{Rk,sp}$	[kN]	3,5	4,0	8,5	9,0	12,0	17,0	11,0	19,0	25,0
	spacing	$s_{cr,sp}$	[mm]	120	160	240	200	240	290	230	280	320
	edge distance	$c_{cr,sp}$	[mm]	60	80	120	100	120	145	115	140	160
Splitting failure case 2	resistance	$N^0_{Rk,sp}$	[kN]	[2)]	2,5	5,5	5,5	8,0	11,0	7,0	15,0	20,0
	spacing	$s_{cr,sp}$	[mm]	[2)]	116	168	128	164	196	160	224	260
	edge distance	$c_{cr,sp}$	[mm]	[2)]	58	84	64	82	98	80	114	130
Pry-out failure												
Factor for pry-out failure		k_8	[-]	1,0	1,6		2,1	2,8		2,5		
Installation factor		γ_{inst}	[-]	1,0								
Concrete edge failure												
Effective length in concrete		l_f	[mm]	35	45	55	45	55	65	55	75	85
Nominal outer diameter of screw		d_{nom}	[mm]	6			8			10		

1) only for statically indeterminate non-structural systems (multiple use) according to EN 1992-4:2018, only in dry internal conditions

2) no performance assessed

TOGE concrete screw TSM high performance LT

Performances
Characteristic values for static and quasi-static loading continuation

Annex C2

Deutsches Institut für Bautechnik DIBt

Table 8: Seismic category C1 – Characteristic load values (only type S, type SK, type ST, type ST-6[1)], type P and type I[1)])

TSM concrete screw size			6		8		10	
Nominal embedment depth		h_{nom}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom3}	h_{nom1}	h_{nom3}
		[mm]	45	55	45	65	55	85
Steel failure for tension and shear load (version **type S, type SK, type ST, type ST-6[1)], type P and type I[1)]**)								
Characteristic tension load	$N_{Rk,s,C1}$	[kN]	14,0		27,0		45,0	
Partial factor	$\gamma_{Ms,N}$	[-]	1,5					
Characteristic shear load **Type S, Type ST, Type P**	$V_{Rk,s,C1}$	[kN]	3,5	4,0	8,0	10,0	14,0	16,0
Characteristic shear load **Type SK**	$V_{Rk,s,C1}$	[kN]	2,5	[2)]	4,5	7,0	14,0	10,0
Partial factor	$\gamma_{Ms,V}$	[-]	1,25					
Without filling of the annular gap [3)]	α_{gap}	[-]	0,5					
With filling of the annular gap [4)]	α_{gap}	[-]	1,0					
Pull-out failure (version **type S, type SK, type ST, type ST-6[1)], type P and type I[1)]**)								
Characteristic tension load in cracked concrete C20/25	$N_{Rk,p,C1}$	[kN]	1,5	3,0	3,0	8,5	6,0	17,0
Concrete cone failure (version **type S, type SK, type ST, type ST-6[1)], type P and type I[1)]**)								
Effective embedment depth	h_{ef}	[mm]	34	42	32	49	40	65
Edge distance	$c_{cr,N}$	[mm]	1,5 x h_{ef}					
Spacing	$s_{cr,N}$	[mm]	3 x h_{ef}					
Installation safety factor	γ_{inst}	[-]	1,0					
Concrete pry-out failure (version **type S, type SK, type ST and type P**)								
Factor for pry-out failure	k_8	[-]	1,6		2,1	2,8	2,5	
Concrete edge failure (version **type S, type SK, type ST and type P**)								
Effective length in concrete	l_f	[mm]	45	55	45	65	55	85
Nominal outer diameter of screw	d_{nom}	[mm]	6		8		10	

[1)] only tension load
[2)] no performance assessed
[3)] without filling of the annular gap according to annex B5
[4)] with filling of the annular gap according to annex B7

TOGE concrete screw TSM high performance LT

Performances
Seismic category C1 – Characteristic load values

Annex C3

Deutsches Institut für Bautechnik DIBt

Table 9: Fire exposure – characteristic values of resistance

TSM concrete screw size				6			8			10		
Nominal embedment depth			h_{nom}	1[1)]	2	3	1	2	3	1	2	3
			[mm]	35	45	55	45	55	65	55	75	85
Steel failure for tension and shear load												
characteristic Resistance	R30	$N_{Rk,s,fi30}$	[kN]	0,9			2,4			4,4		
	R60	$N_{Rk,s,fi60}$	[kN]	0,8			1,7			3,3		
	R90	$N_{Rk,s,fi90}$	[kN]	0,6			1,1			2,3		
	R120	$N_{Rk,s,fi120}$	[kN]	0,4			0,7			1,7		
	R30	$V_{Rk,s,fi30}$	[kN]	0,9			2,4			4,4		
	R60	$V_{Rk,s,fi60}$	[kN]	0,8			1,7			3,3		
	R90	$V_{Rk,s,fi90}$	[kN]	0,6			1,1			2,3		
	R120	$V_{Rk,s,fi120}$	[kN]	0,4			0,7			1,7		
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,7			2,4			5,9		
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,6			1,8			4,5		
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,5			1,2			3,0		
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,3			0,9			2,3		
Pull-out failure												
characteristic Resistance	R30-90	$N_{Rk,p,fi}$	[kN]	0,6	0,4	0,8	0,8	1,4	2,0	1,5	3,3	4,3
	R120	$N_{Rk,p,fi}$	[kN]	0,5	0,3	0,6	0,6	1,1	1,6	1,2	2,6	3,4
Concrete cone failure												
characteristic Resistance	R30-90	$N^0_{Rk,c,fi}$	[kN]	0,5	1,2	2,0	1,0	1,9	2,9	1,7	4,2	5,9
	R120	$N^0_{Rk,c,fi}$	[kN]	0,4	0,9	1,6	0,8	1,5	2,3	1,4	3,4	4,7
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 bis R120		$s_{cr,fi}$	[mm]	$4 \times h_{ef}$								
Pry-out failure												
R30 bis R120		k_8	[-]	1,0	1,6		2,1	2,8		2,5		
The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value.												

[1)] only for statically indeterminate non-structural systems (multiple use) according to EN 1992-4:2018, only in dry internal conditions

TOGE concrete screw TSM high performance LT

Performances
Fire exposure – characteristic values of resistance

Annex C4

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Table 10: Displacements under static and quasi-static tension load

TSM concrete screw size				6		8			10		
Nominal embedment depth			h_{nom}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
			[mm]	45	55	45	55	65	55	75	85
Cracked concrete	tension load	N	[kN]	0,72	1,45	1,63	2,74	4,06	3,04	6,22	8,46
	displacement	δ_{N0}	[mm]	0,19	0,27	0,27	0,53	0,45	0,26	0,58	0,61
		$\delta_{N\infty}$	[mm]	0,55	0,84	0,49	0,66	0,61	0,69	0,92	1,1
Uncracked concrete	tension load	N	[kN]	2,11	4,07	4,24	5,97	8,03	5,42	9,17	12,28
	displacement	δ_{N0}	[mm]	0,42	0,43	0,33	0,49	0,58	0,84	0,62	0,79
		$\delta_{N\infty}$	[mm]	0,42	0,43	0,58			0,79		

Table 11: Displacements under static and quasi-static shear load

TSM concrete screw size				6		8			10		
Nominal embedment depth			h_{nom}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
			[mm]	45	55	45	55	65	55	75	85
Cracked and uncracked concrete	shear load	V	[kN]	3,3		8,6			16,2		
	displacement	δ_{V0}	[mm]	1,55		2,7			2,7		
		$\delta_{V\infty}$	[mm]	3,1		4,1			4,3		