Designated according to The Construction Products (Amendment etc.) (EU Exit) Regulations 2020

UK Technical Assessment	UKTA-0836-22/6551 of 20/12/2022
Technical Assessment Body issuing the UK Technical Assessment:	British Board of Agrément
Trade name of the construction product:	TSM high performance, TSM high performance A4, TSM high performance HCR
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(s):	TOGE Dübel GmbH & Co. KG
This UK Technical Assessment contains:	23 pages including 3 Annexes which form an integral part of this assessment.
This UK Technical Assessment is issued in accordance with The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 on the basis of:	UKAD 330232-00-0601 *Mechanical fasteners for use in concrete*

1 Technical description of the product

The TOGE Concrete screw TSM high performance is an anchor in sizes 6, 8, 10, 12 and 14 mm manufactured from galvanized 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 are given in Annex A.

2 Specification of the intended use(s) in accordance with the applicable UK Assessment Document (hereinafter UKAD)

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 UK 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 C 1 and C 2
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1 and C 2
Displacements (static and quasi-static loading)	See Annex C 7
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 3, C 4, C 5 and C 8
Durability	See Annex B 1

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 6

3.3 Health, hygiene, and the environment (BWR 3)

Not relevant.

3.4 Safety and accessibility in use (BWR 4)

Not relevant.

3.5 Protection against noise (BWR 5)

Not relevant.

3.6 Energy economy and heat retention (BWR 6)

Not relevant.

3.7 Sustainable use of natural resources (BWR 7)

No performance assessed.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied

4.1 System of assessment and verification of constancy of performance

According to UKAD No. 330232-00-0601 and Annex V of the Construction Products Regulation (Regulation (EU)) 305/2011 as brought into UK law and amended, the system of assessment and verification of constancy of performance (AVCP) 1 applies.

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable UKAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the British Board of Agrément and made available to the UK Approved Bodies involved in the conformity attestation process.

5.1 UKCA marking for the product/ system must contain the following information:

- Identification number of the Approved Body
- Name/address of the manufacturer of the product/ system
- Marking with intention of clarification of intended use
- Date of marking
- Number of certificate of constancy of performance (where applicable)
- UKTA number.

On behalf of the British Board of Agrément 	
Date of Issue: 20 December 2022	**Hardy Giesler** Chief Executive Officer

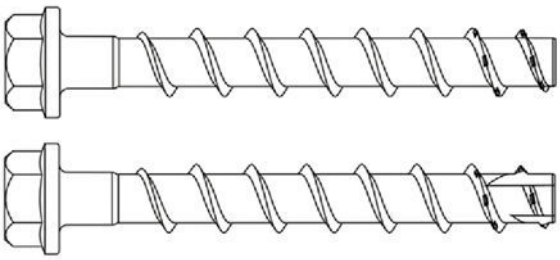
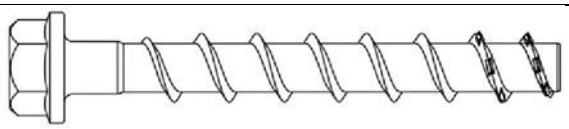
Certificate amended on 23 May 2023 to reintroduce Tables 8, 9 and 10.

British Board of Agrément,
1st Floor Building 3,
Hatters Lane,
Croxley Park
Watford
WD18 8YG

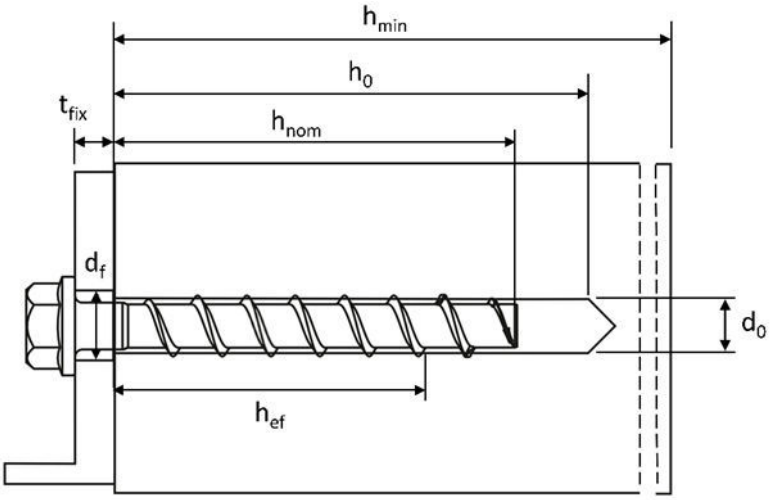
ANNEX A1 Product in installed condition

This annex applies to the product described in the main body of the UK Technical Assessment.

TOGE concrete screw TSM high performance

- Galvanized carbon steel - Zinc flakes coated carbon steel	- Stainless steel A4 - Stainless steel HCR
	

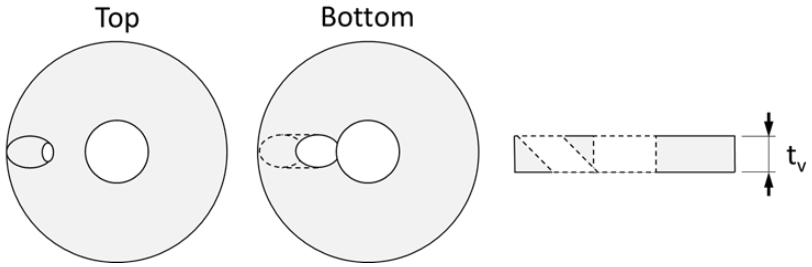
e.g. TOGE concrete screw, zinc flakes coated, with hexagon head and fixture



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

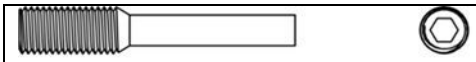
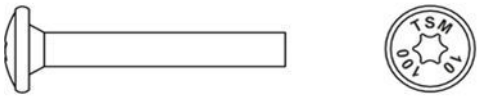
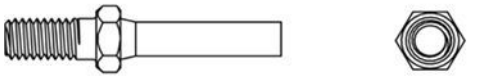
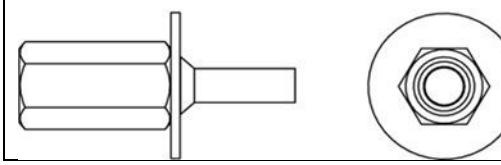
h_{min} = minimum thickness of member
h_{nom} = nominal embedment depth
h_0 = drill hole depth
h_{ef} = effective embedment depth

Filling washer (optional)
to fill annular gap



ANNEX A2 Screw types

This annex applies to the product described in the main body of the UK Technical Assessment.

	Configuration with metric connection thread and hexagon socket e.g. TSM 8x105 M10 SW5; Type ST
	Configuration with metric connection thread and hexagon drive e.g. TSM 8x105 M10 SW7; Type ST
	Configuration with washer and hexagon head e.g. TSM 8x80 SW13 VZ 40; Type S
	Configuration with washer, hexagon head and TORX drive e.g. TSM 8x80 SW13; Type S
	Configuration with washer and bund e.g. TSM BC ST 14x130 SW24 VZ 40; Type BND
	Configuration with hexagon head e.g. TSM 8x80 SW13 OS; Type S
	Configuration with countersunk head and TORX drive e.g. TSM 8x80 C VZ 40; Type SK
	Configuration with pan head and TORX drive e.g. TSM 8x80 P VZ 40; Type P
	Configuration with large pan head and TORX drive e.g. TSM 8x80 LP VZ 40; Type P
	Configuration with countersunk head and connection thread e.g. TSM 6x55 AG M8; Type ST-6
	Configuration with hexagon drive and connection thread e.g. TSM 6x55 M8 SW10; Type ST-6
	Configuration with internal thread and hexagon drive e.g. TSM 6x55 IM M8/10; Type I

ANNEX A3 Material, Dimensions and markings

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 1: Material

Part	Product name	Material
all types	TSM high performance	- Steel BS EN 10263-4:2017 galvanized acc. to BS EN ISO 4042:2018 - Zinc flake coating according to BS EN ISO 10683:2018 (≥5µm) - Zinc flake coating according to BS EN ISO 10683:2018 special coating TOGE KORR (≥20µm)
	TSM high performance A4	1.4401; 1.4404; 1.4571; 1.4578
	TSM high performance HCR	1.4529

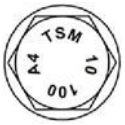
Part	Product name	Nominal characteristic steel		Rupture elongation A_5 [%]
		Yield strength f_{yk} [N.mm^{-2}]	Ultimate strength f_{uk} [N.mm^{-2}]	
all types	TSM high performance TSM high performance A4 TSM high performance HCR	560	700	≤ 8

Table 1: Dimensions

Anchor size			6		8			10			12			14		
Nominal embedment depth		h_{nom}	1	2	1	2	3	1	2	3	1	2	3	1	2	3
		[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Screw length	≤ L	[mm]	500													
Core diameter	d_K	[mm]	5,1		7,1			9,1			11,1			13,1		
Thread outer diameter	d_s	[mm]	7,5		10,6			12,6			14,6			16,6		
Thickness of filling washer	t_v	[mm]	-		5			5			5			5		

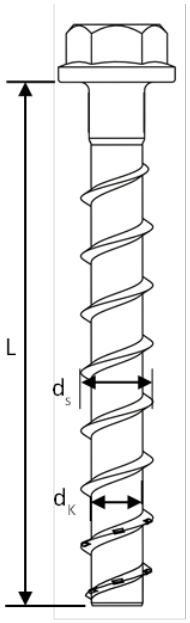
Marking:
TSM high performance
Screw type: TSM
Screw size: 10
Screw length: 100

TSM high performance A4
Screw type: TSM
Screw size: 10
Screw length: 100
Material: A4



TSM high performance BC ST
Screw type: TSM BC ST
Screw size: 10
Screw length: 100

TSM high performance HCR
Screw type: TSM
Screw size: 10
Screw length: 100
Material: HCR



ANNEX B1 Specification of Intended use

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 3: Anchorages subject to

TSM concrete screw size		6		8			10			12			14		
Nominal embedment depth		h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
	[mm]	40	55	45	55	65	55	75	85	65	85	100	65	85	115
Static and quasi-static loads		All sizes and all embedment depths													
Fire exposure															
C1 category - seismic performance		ok	ok				ok								
C2 category – seismic (A4 and HCR: no performance assessed)		[1]		[1]		ok	[1]	[1]	ok	[1]		ok	[1]		ok

[1] no performance assessed

Base materials:

- Compacted reinforced and unreinforced concrete without fibres according to BS EN 206:2013
- Strength classes C20/25 to C50/60 according to BS 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).

ANNEX B2 Specification of Intended use - continuation

This annex applies to the product described in the main body of the UK Technical Assessment.

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 BS EN 1992-4:2018

- The design for shear load according to BS 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.

- 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 6-14, all embedment depths except for seismic application.

- Cleaning of borehole is not necessary, if using a hollow drill.

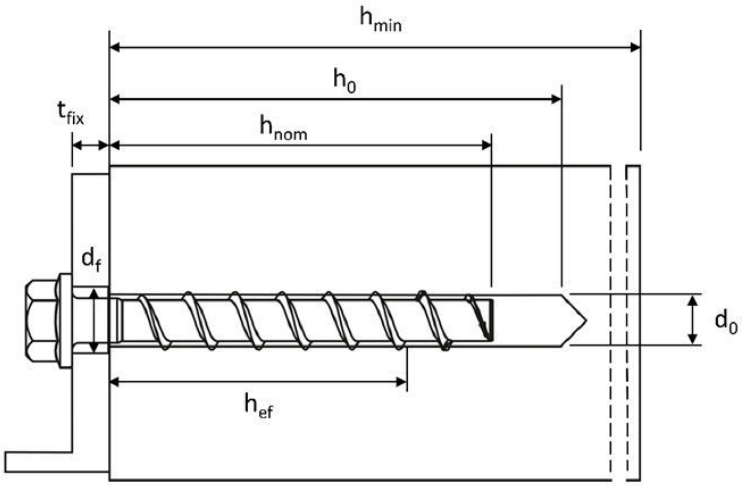
ANNEX B3 Installation parameters

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 4: Installation parameters

TSM concrete screw size			**6**		**8**			**10**		
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		[mm]	40	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		
Drill hole depth	$h_0 \geq$	[mm]	45	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 screwdriver		[Nm]	Maximum torque according to manufacturer's instructions							
			160		300			400		

TSM concrete screw size			**12**			**14**		
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		[mm]	65	85	100	75	100	115
Nominal drill hole diameter	d_0	[mm]	12			14		
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	12,50			14,50		
Drill hole depth	$h_0 \geq$	[mm]	75	95	110	85	110	125
Clearance hole diameter	$d_f \leq$	[mm]	16			18		
Installation torque (version with connection thread)	T_{inst}	[Nm]	60			80		
Torque impact screwdriver		[Nm]	Maximum torque according to manufacturer's instructions					
			650			650		



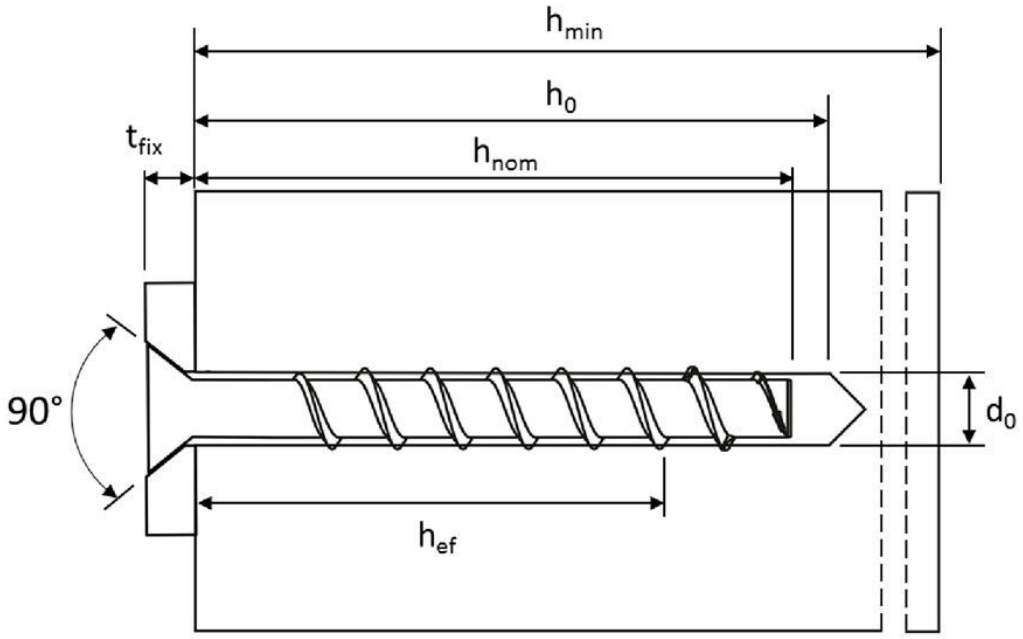
ANNEX B4 Intended use
Minimum thickness of member, minimum edge distance and minimum spacing

This annex applies to the product described in the main body of the UK Technical Assessment.

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}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		[mm]	40	55	45	55	65	55	75	85
Minimum thickness of member	h_{min}	[mm]	100		100		120	100	130	
Minimum edge distance	c_{min}	[mm]	40		40	50		50		
Minimum spacing	s_{min}	[mm]	40		40	50		50		

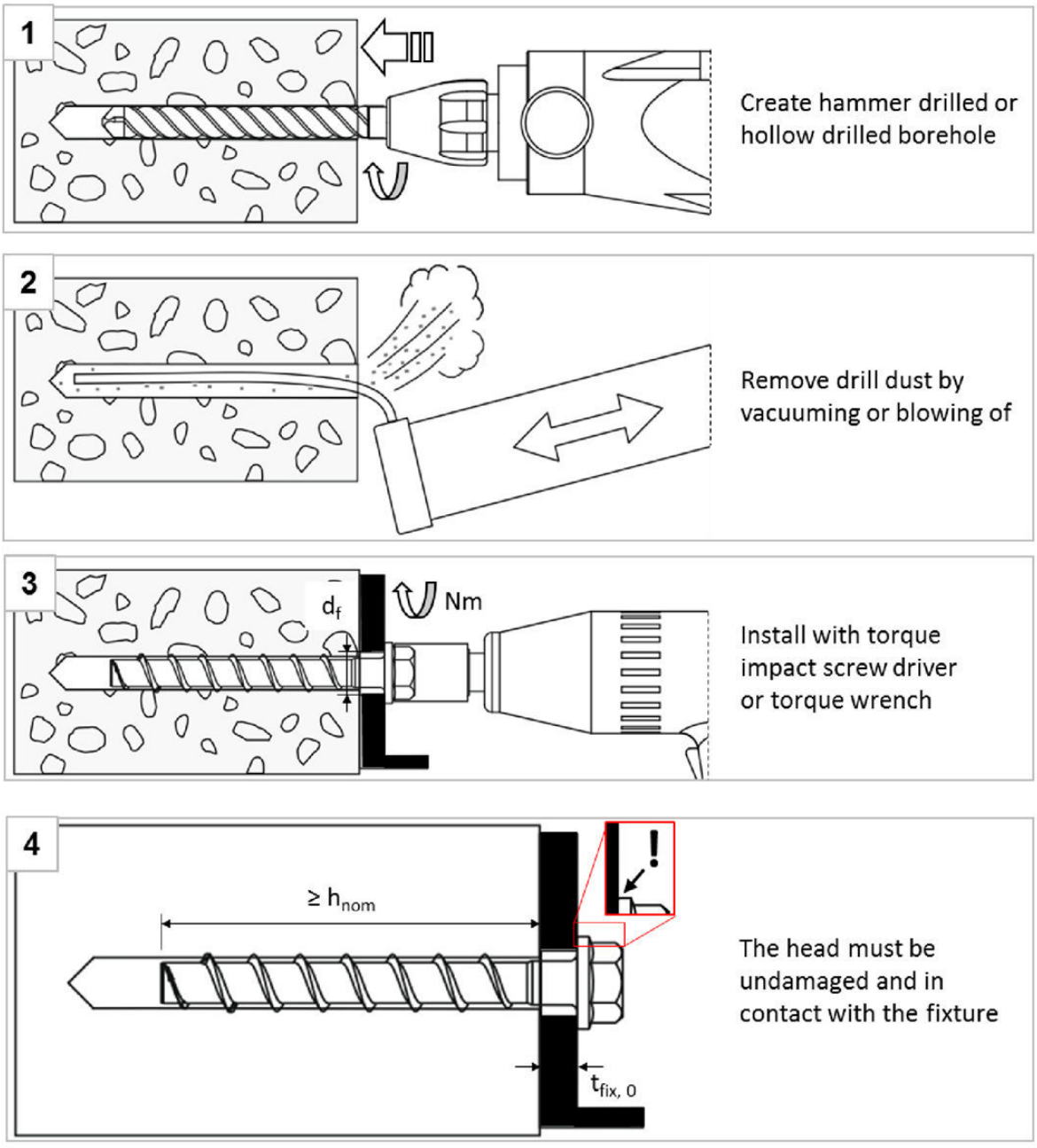
TSM concrete screw size			**12**			**14**		
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		[mm]	65	85	100	75	100	115
Minimum thickness of member	h_{min}	[mm]	120	130	150	130	150	170
Minimum edge distance	c_{min}	[mm]	50		70	50	70	
Minimum spacing	s_{min}	[mm]	50		70	50	70	



ANNEX B5 Intended use, Installation instructions

This annex applies to the product described in the main body of the UK Technical Assessment.

Installation Instructions



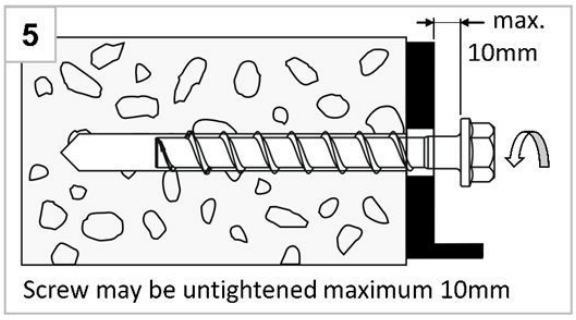
Note:
Cleaning of borehole is not necessary when using a hollow drill

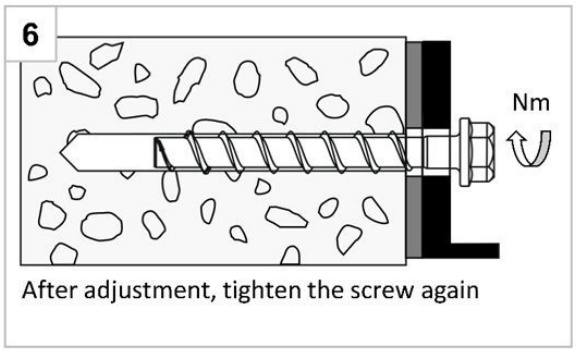
ANNEX B6 Intended use, Installation instructions - Adjustment

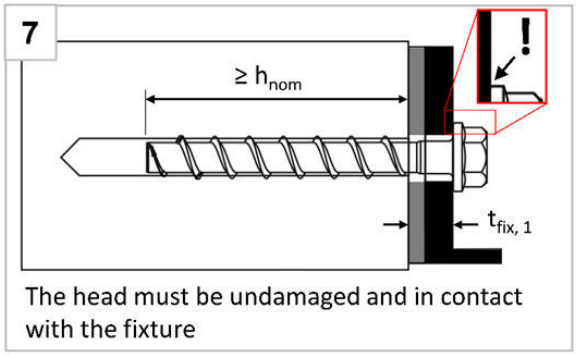
This annex applies to the product described in the main body of the UK Technical Assessment.

Installation Instructions – Adjustment

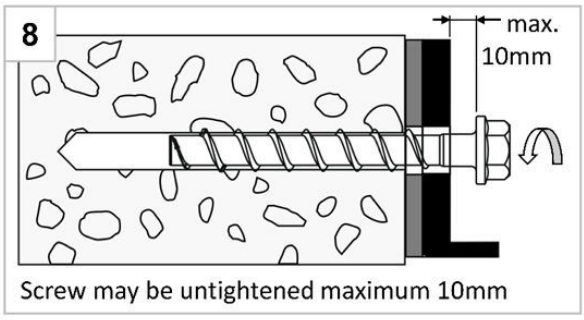
1. Adjustment

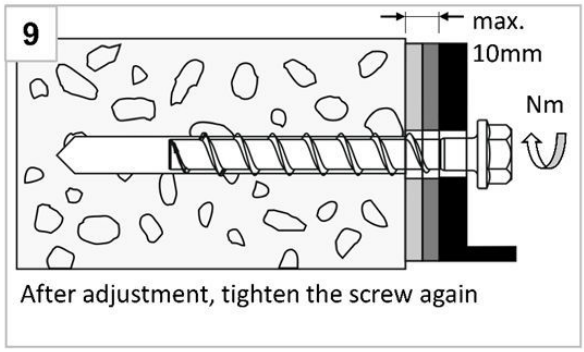


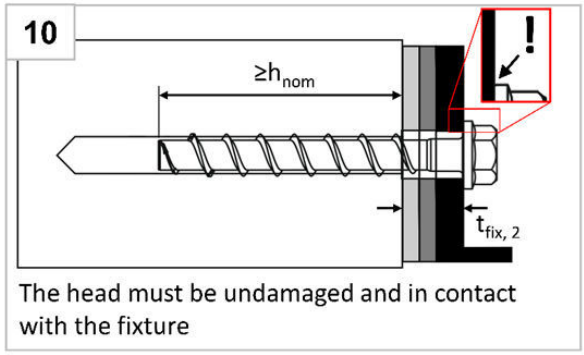




2. Adjustment







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}.

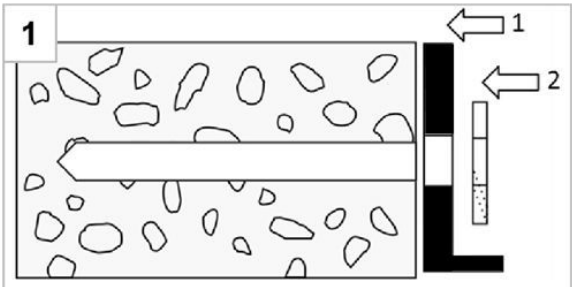
ANNEX B7 Intended use, Installation instructions - Filling annular gap

This annex applies to the product described in the main body of the UK Technical Assessment.

Installation Instructions – Filling annular gap

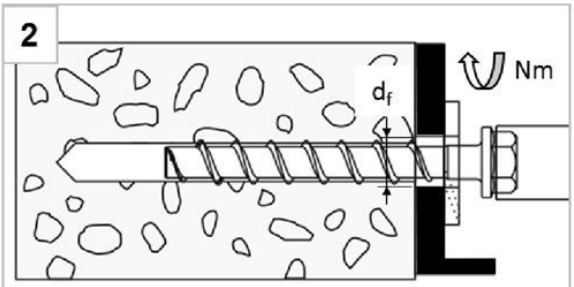
Positioning of fixture and filling washer

1



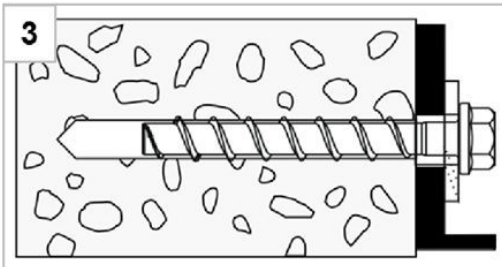
After preparing borehole (Annex B5, figure 1+2), position first fixture (1), than filling washer (2)

2



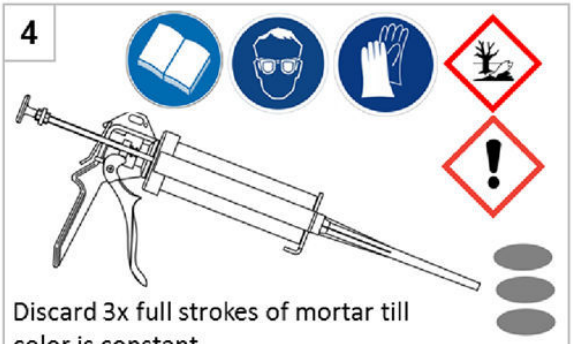
Install with torque impact screw driver or torque wrench

3



Installed condition without injected mortar in the filling washer

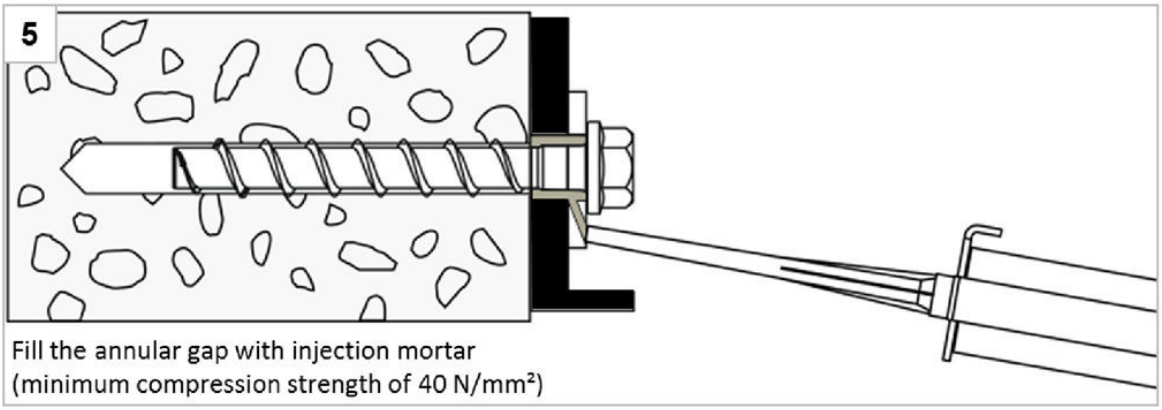
4



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 C5 - C7.

ANNEX C1 Performances, Characteristic values for static and quasi-static loading, sizes 6-10

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 2: Characteristic values for static and quasi-static loading, sizes 6-10

TSM concrete screw size				**6**		**8**			**10**		
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		[mm]	40	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										
Characteristic tension load C20/25	cracked	$N_{Rk,p}$	[kN]	2,0	4,0	5,0	9,0	12,0	9,0	≥ $N^0_{Rk,c}$ 1)
	uncracked	$N_{Rk,p}$	[kN]	4,0	9,0	7,5	12,0	16,0	12,0	20,0	26,0
Increasing factor for $N_{Rk,p}$	C25/30	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]	31	44	35	43	52	43	60	68
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	resistance	$N^0_{Rk,sp}$	[kN]	4,0	9,0	7,5	12,0	16,0	12,0	20,0	26,0
	spacing	$s_{cr,Sp}$	[mm]	120	160	120	140	150	140	180	210
	edge distance	$c_{cr,Sp}$	[mm]	60	80	60	70	75	70	90	105
Factor for pry-out failure		k_8	[-]	1,0						2,0	
Installation factor		γ_{inst}	[-]	1,0							
Concrete edge failure											
Effective length in concrete		$l_f = h_{ef}$	[mm]	31	44	35	43	52	43	60	68
Nominal outer diameter of screw		d_{nom}	[mm]	6		8			10		

1) $N^0_{Rk,c}$ according to BS EN 1992-4:2018

ANNEX C2 Performances, Characteristic values for static and quasi-static loading, sizes 12-14

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 7: Characteristic values for static and quasi-static loading, sizes 12-14

TSM concrete screw size			**12**			**14**			1)
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}	
		[mm]	65	85	100	75	100	115	

Steel failure for tension and shear loading						
Characteristic tension load	$N_{Rk,s}$	[kN]	67,0		94,0	
Partial factor	$\gamma_{Ms,N}$	[-]	1,5			
Characteristic shear load	$V^0_{Rk,s}$	[kN]	33,5	42,0	56,0	
Partial factor	$\gamma_{Ms,V}$	[-]	1,25			
Ductility factor	k_7	[-]	0,8			
Characteristic bending load	$M^0_{Rk,s}$	[Nm]	113,0		185,0	

Pull-out failure					
Characteristic tension load C20/25	cracked	$N_{Rk,p}$	[kN]	12,0	≥ $N^0_{Rk,c}$ 1)
	uncracked	$N_{Rk,p}$	[kN]	16,0	
Increasing factor for $N_{Rk,p}$	C25/30	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]	50	67	80	58	79	92	
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	resistance	$N^0_{Rk,sp}$	[kN]	16,0	27,0	35,0	21,5	34,5	43,5	
	spacing	$s_{cr,Sp}$	[mm]	150	210	240	180	240	280	
	edge distance	$c_{cr,Sp}$	[mm]	75	105	120	90	120	140	
Factor for pry-out failure		k_8	[-]	1,0	2,0		1,0	2,0		
Installation factor		γ_{inst}	[-]	1,0						

Concrete edge failure									
Effective length in concrete	$l_f = h_{ef}$	[mm]	50	67	80	58	79	92	
Nominal outer diameter of screw	d_{nom}	[mm]	12			14			

$N^0_{Rk,c}$ according to BS EN 1992-4:2018

ANNEX C3 Performances, Seismic category C1 – Characteristic load values

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 3: Seismic category C1 – Characteristic load values (type S, type SK, type ST, type ST-6[1)], type P and type I[1)])

TSM concrete screw size			6		8	10		12	14
Nominal embedment depth		h_{nom}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom3}	h_{nom3}	h_{nom3}
		[mm]	40	55	65	55	85	100	115
Steel failure for tension and shear load (version **type S**, **type SK, type ST, type ST-6[1)], type P, type I[1)]**)									
Characteristic load	$N_{Rk,s,eq}$	[kN]	14,0		27,0	45,0		67,0	94,0
Partial factor	$\gamma_{Ms,eq}$	[-]	1,5						
Characteristic load	$V_{Rk,s,eq}$	[kN]	4,7	5,5	8,5	13,5	15,3	21,0	22,4
Partial factor	$\gamma_{Ms,eq}$	[-]	1,25						
With filling of the annular gap [2)]	α_{gap}	[-]	1,0						
Without filling of the annular gap [3)]	α_{gap}	[-]	0,5						
Pull-out failure (version **type S**, **type SK, type ST, type ST-6[1)], type P, type I[1)]**)									
Characteristic tension load in cracked concrete C20/25	$N_{Rk,p,eq}$	[kN]	2,0	4,0	12,0	9,0	$\geq N^0_{Rk,c}$ [4)]		
Concrete cone failure (version **type S**, **type SK, type ST, type ST-6[1)], type P, type I[1)]**)									
Effective embedment depth	h_{ef}	[mm]	31	44	52	43	68	80	92
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, type P**)									
Factor for pry-out failure	k_8	[-]	1,0				2,0		
Concrete edge failure (version **type S**, **type SK, type ST, type P**)									
Effective length in concrete	$l_f = h_{ef}$	[mm]	31	44	52	43	68	80	92
Nominal outer diameter of screw	d_{nom}	[mm]	6	6	8	10	10	12	14

[1)] only tension load
[2)] With filling of the annular gap according to annex B7, figure 5
[3)] Without filling of the annular gap according to annex B5
[4)] $N^0_{Rk,c}$ according to EN 1992-4:2018

ANNEX C4 Performances,
Seismic category C2 – Characteristic load values with filled annular gap

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 4: Seismic category C2 [1)] – Characteristic load values with filled annular gap according to annex B7, figure 5 (type S, type ST, type P)

TSM concrete screw size			8	10	12	14
Nominal embedment depth		h_{nom}	h_{nom3}			
		[mm]	65	85	100	115
Steel failure for tension and shear load (version **type S, type ST, type P**)						
Characteristic load	$N_{Rk,s,eq}$	[kN]	27,0	45,0	67,0	94,0
Partial factor	$\gamma_{Ms,eq}$	[-]	1,5			
Characteristic load	$V_{Rk,s,eq}$	[kN]	9,9	18,5	31,6	40,7
Partial factor	$\gamma_{Ms,eq}$	[-]	1,25			
With filling of the annular gap	α_{gap}	[-]	1,0			
Pull-out failure (version **type S, type ST, type P**)						
Characteristic load in cracked concrete	$N_{Rk,p,eq}$	[kN]	2,4	5,4	7,1	10,5
Concrete cone failure (version **type S, type ST, type P**)						
Effective embedment depth	h_{ef}	[mm]	52	68	80	92
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 ST, type P**)						
Factor for pry-out failure	k_8	[-]	1,0	2,0		
Concrete edge failure (version **type S, type ST, type P**)						
Effective length in concrete	$l_f = h_{ef}$	[mm]	52	68	80	92
Nominal outer diameter of screw	d_{nom}	[mm]	8	10	12	14

[1)] A4 and HCR not suitable

ANNEX C5 Performances,
Seismic category C2 – Characteristic load values without filled annular gap.

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 5: Seismic category C2 [1)] – Characteristic load values without filled annular gap according to annex B5 (type S, type ST, type P)

TSM concrete screw size			8	10	12	14
Nominal embedment depth		h_{nom}	h_{nom3}			
		[mm]	65	85	100	115
Steel failure for tension and shear load (version **type S, type ST, type P**)						
Characteristic load	$N_{Rk,s,eq}$	[kN]	27,0	45,0	67,0	94,0
Partial factor	$\gamma_{Ms,eq}$	[-]	1,5			
Characteristic load	$V_{Rk,s,eq}$	[kN]	10,3	21,9	24,4	23,3
Partial factor	$\gamma_{Ms,eq}$	[-]	1,25			
Without filling of the annular gap	α_{gap}	[-]	0,5			
Pull-out failure (version **type S, type ST, type P**)						
Characteristic load in cracked concrete	$N_{Rk,p,eq}$	[kN]	2,4	5,4	7,1	10,5
Steel failure for tension and shear load (version **type SK**)						
Characteristic load	$N_{Rk,s,eq}$	[kN]	27,0	45,0	no performance assessed	
Partial factor	$\gamma_{Ms,eq}$	[-]	1,5			
Characteristic load	$V_{Rk,s,eq}$	[kN]	3,6	13,7		
Partial factor	$\gamma_{Ms,eq}$	[-]	1,25			
Without filling of the annular gap	α_{gap}	[-]	0,5			
Pull-out failure (version **type SK**)						
Characteristic load in cracked concrete	$N_{Rk,p,eq}$	[kN]	2,4	5,4	no performance assessed	
Concrete cone failure (version **type S, type SK, type ST, type P**)						
Effective embedment depth	h_{ef}	[mm]	52	68	80	92
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, type P**)						
Factor for pry-out failure	k_8	[-]	1,0	2,0		
Concrete edge failure (version **type S, type SK, type ST, type P**)						
Effective length in concrete	$l_f = h_{ef}$	[mm]	52	68	80	92
Nominal outer diameter of screw	d_{nom}	[mm]	8	10	12	14

[1)] A4 and HCR not suitable

ANNEX C6 Performances, Fire exposure – characteristic values of resistance

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 11: Fire exposure – characteristic values of resistance

TSM concrete screw size				**6**		**8**			**10**			**12**			**14**		
Nominal embedment depth			h_{nom}	1	2	1	2	3	1	2	3	1	2	3	1	2	3
			[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Steel failure for tension and shear load																	
characteristic Resistance	R30	$N_{Rk,s,fi30}$	[kN]	0,9		2,4			4,4			7,3			10,3		
	R60	$N_{Rk,s,fi60}$	[kN]	0,8		1,7			3,3			5,8			8,2		
	R90	$N_{Rk,s,fi90}$	[kN]	0,6		1,1			2,3			4,2			5,9		
	R120	$N_{Rk,s,fi120}$	[kN]	0,4		0,7			1,7			3,4			4,8		
	R30	$V_{Rk,s,fi30}$	[kN]	0,9		2,4			4,4			7,3			10,3		
	R60	$V_{Rk,s,fi60}$	[kN]	0,8		1,7			3,3			5,8			8,2		
	R90	$V_{Rk,s,fi90}$	[kN]	0,6		1,1			2,3			4,2			5,9		
	R120	$V_{Rk,s,fi120}$	[kN]	0,4		0,7			1,7			3,4			4,8		
	R30	$M^0_{Rk,s,fi30}$	[Nm]	0,7		2,4			5,9			12,3			20,4		
	R60	$M^0_{Rk,s,fi60}$	[Nm]	0,6		1,8			4,5			9,7			15,9		
	R90	$M^0_{Rk,s,fi90}$	[Nm]	0,5		1,2			3,0			7,0			11,6		
	R120	$M^0_{Rk,s,fi120}$	[Nm]	0,3		0,9			2,3			5,7			9,4		
Pull-out failure																	
Characteristic Resistance	R30-R90	$N_{Rk,p,fi}$	[kN]	0,5	1,0	1,3	2,3	3,0	2,3	4,0	4,8	3,0	4,7	6,2	3,8	6,0	7,6
	R120	$N_{Rk,p,fi}$	[kN]	0,4	0,8	1,0	1,8	2,4	1,8	3,2	3,9	2,4	3,8	4,9	3,0	4,8	6,1
Concrete cone failure																	
Characteristic Resistance	R30-R90	$N^0_{Rk,c,fi}$	[kN]	0,9	2,2	1,2	2,1	3,4	2,1	4,8	6,6	3,0	6,3	9,9	4,4	9,6	14,0
	R120	$N^0_{Rk,c,fi}$	[kN]	0,7	1,8	1,0	1,7	2,7	1,7	3,8	5,3	2,4	5,1	7,9	3,5	7,6	11,2
Edge distance																	
R30 bis 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					2,0			1,0	2,0		1,0	2,0	
The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given value.																	

ANNEX C7 Performances, Displacements under static and quasi-static loads

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 12: Displacements under static and quasi-static tension load

TSM concrete screw size				**6**		**8**			**10**		
Nominal embedment depth			h_{nom}	h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
			[mm]	40	55	45	55	65	55	75	85
Cracked concrete	tension load	N	[kN]	0,95	1,9	2,4	4,3	5,7	4,3	7,9	9,6
	displacement	δ_{N0}	[mm]	0,3	0,6	0,6	0,7	0,8	0,6	0,5	0,9
		$\delta_{N\infty}$	[mm]	0,4	0,4	0,6	1,0	0,9	0,4	1,2	1,2
Uncracked concrete	tension load	N	[kN]	1,9	4,3	3,6	5,7	7,6	5,7	9,5	11,9
	displacement	δ_{N0}	[mm]	0,4	0,6	0,7	0,9	0,5	0,7	1,1	1,0
		$\delta_{N\infty}$	[mm]	0,4	0,4	0,6	1,0	0,9	0,4	1,2	1,2

TSM concrete screw size				**12**			**14**		
Nominal embedment depth			h_{nom}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
			[mm]	65	85	100	75	100	115
Cracked concrete	tension load	N	[kN]	5,7	9,4	12,3	7,6	12,0	15,1
	displacement	δ_{N0}	[mm]	0,9	0,5	1,0	0,5	0,8	0,7
		$\delta_{N\infty}$	[mm]	1,0	1,2	1,2	0,9	1,2	1,0
Uncracked concrete	tension load	N	[kN]	7,6	13,2	17,2	10,6	16,9	21,2
	displacement	δ_{N0}	[mm]	1,0	1,1	1,2	0,9	1,2	0,8
		$\delta_{N\infty}$	[mm]	1,0	1,2	1,2	0,9	1,2	1,0

Table 13: Displacements under static and quasi-static shear load

TSM concrete screw size				**6**		**8**			**10**		
Nominal embedment depth		h_{nom}		h_{nom1}	h_{nom2}	h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		[mm]		40	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		

TSM concrete screw size				**12**			**14**		
Nominal embedment depth		h_{nom}		h_{nom1}	h_{nom2}	h_{nom3}	h_{nom1}	h_{nom2}	h_{nom3}
		[mm]		65	85	100	75	100	115
Cracked and uncracked concrete	shear load	V	[kN]	20,0			30,5		
	displacement	δ_{V0}	[mm]	4,0			3,1		
		$\delta_{V\infty}$	[mm]	6,0			4,7		

ANNEX C8 Performances, Displacements under seismic loads

This annex applies to the product described in the main body of the UK Technical Assessment.

Table 6: Seismic category C2 [1)] – Displacements **with filled annular gap according to annex B7, figure 5** (type S, type ST, type P)

TSM concrete screw size			8	10	12	14
Nominal embedment depth		h_{nom}	h_{nom3}			
		[mm]	65	85	100	115
Displacements under tension loads (version **type S, type ST, type P**)						
Displacement DLS	$\delta_{N,eq(DLS)}$	[mm]	0,66	0,32	0,57	1,16
Displacement ULS	$\delta_{N,eq(ULS)}$	[mm]	1,74	1,36	2,36	4,39
Displacements under shear loads (version **type S, type ST, type P** with hole clearance)						
Displacement DLS	$\delta_{V,eq(DLS)}$	[mm]	1,68	2,91	1,88	2,42
Displacement ULS	$\delta_{V,eq(ULS)}$	[mm]	5,19	6,72	5,37	9,27

Table 7: Seismic category C2 [1)] – Displacements **without filled annular gap according to annex B5** (only version type S, type SK, type ST, type P)

TSM concrete screw size			8	10	12	14
Nominal embedment depth		h_{nom}	h_{nom3}			
		[mm]	65	85	100	115
Displacements under tension loads (version **type S, type ST, type P**)						
Displacement DLS	$\delta_{N,eq(DLS)}$	[mm]	0,66	0,32	0,57	1,16
Displacement ULS	$\delta_{N,eq(ULS)}$	[mm]	1,74	1,36	2,36	4,39
Displacements under tension loads (version **type SK**)						
Displacement DLS	$\delta_{N,eq(DLS)}$	[mm]	0,66	0,32	No performance assessed	
Displacement ULS	$\delta_{N,eq(ULS)}$	[mm]	1,74	1,36		
Displacements under shear loads (version **type S, type ST, type P** with hole clearance)						
Displacement DLS	$\delta_{V,eq(DLS)}$	[mm]	4,21	4,71	4,42	5,60
Displacement ULS	$\delta_{V,eq(ULS)}$	[mm]	7,13	8,83	6,95	12,63
Displacements under shear loads (version **type SK** with hole clearance)						
Displacement DLS	$\delta_{V,eq(DLS)}$	[mm]	2,51	2,98	No performance assessed	
Displacement ULS	$\delta_{V,eq(ULS)}$	[mm]	7,76	6,25		

[1)] A4 and HCR not suitable

British Board of Agrément,
1st Floor Building 3,
Hatters Lane,
Croxley Park
Watford
WD18 8YG