... eine starke Verbindung

DECLARATION OF PERFORMANCE

DoP Nr.: **MKT-712** - en

- ✧ **Unique identification code of product-type:** **Concrete Screw BSZ**
- ✧ **Intended use/es:** Mechanical fastener for use in concrete, see Annex B
- ✧ **Manufacturer:** MKT Metall-Kunststoff-Technik GmbH & Co.KG
  Auf dem Immel 2
  67685 Weilerbach
- ✧ **System or systems of assessment and verification of constancy of performance:** 1
- ✧ **European Assessment Document:** **EAD 330011-00-0601 + EAD 330232-00-0601**
  European Technical Assessment: **ETA-16/0204, 19.05.2020**
  Technical Assessment Body: DIBt, Berlin
  Notified body/ies: NB 1343 – MPA, Darmstadt

✧ **Declared performance/s:**

Essential Characteristics	Performance
Mechanical resistance and stability (BWR 1)	
Characteristic resistance to tension load (static and quasi-static loading)	Annex C1
Characteristic resistance to shear load (static and quasi-static loading)	Annex C1
Characteristic resistance and displacements for seismic performance categories C1+C2	Annex C2, C3, C4, C7
Displacements (static and quasi-static loading)	Annex C6
Durability	Annex B1
Safety in case of fire (BWR 2)	
Reaction to fire	Class A1
Resistance to fire	Annex C5

The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above.

Signed for and on behalf of the manufacturer by:

Stefan Weustenhagen
(General manager)
Weilerbach, 19.05.2020

p.p.
Dipl.-Ing. Detlef Bigalke
(Head of product development)

The original of this declaration of performance was written in German. In the event of deviations in the translation, the German version shall be valid.

Specifications of Intended use

Concrete screw BSZ		BSZ 6		BSZ 8			BSZ 10			BSZ 12			BSZ 14		
Nominal anchorage depth h_{nom} [mm]		40	55	45	55	65	55	75	85	65	85	100	75	100	115
Anchorages subject to	Static or quasi-static loading	✓													
	Fire exposure	✓													
	Seismic action C1	✓		-		✓	✓	-	✓	-		✓	-		✓
	Seismic action C2 (concrete screw BSZ, zinc plated)	-		-		✓	-	-	✓	-		✓	-		✓
Base material	Cracked or uncracked concrete	✓													
	Reinforced or unreinforced concrete (without fibres) acc. to EN 206:2013	✓													
	Strength classes according to EN 206:2013: C20/25 to C50/60	✓													

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
  (zinc plated steel, stainless steel or high corrosion resistant steel)
- Structures subject to external atmospheric exposure including industrial and marine environment or exposure to permanently damp internal condition, if no particular aggressive conditions exist
  (stainless steel or high corrosion resistant steel)
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist (high corrosion resistant steel)

  Note: Particular aggressive conditions are e.g. permanent, alternation immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where 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 are designed according to EN 1992-4:2018 and EOTA Technical Report TR 055.

Installation:

- Making of drill hole by hammer drilling (all sizes) or vacuum drill bit (BSZ 8 – BSZ 14).
  When using a vacuum drill bit no drill hole cleaning is required.
- Anchor installation carried out by appropriately qualified personal and under the responsibility of the person responsible for technical matters on site.
- After installation further turning of the anchor is not possible. The head of the anchor is supported on the fixture and is not damaged.
- The borehole may be filled with the Injection Systems VME or VME plus.
- Adjustment according to Annex B4: for concrete bolts BSZ 8 to BSZ 14, all anchorage depths

Table B1: Installation parameters

Anchor size			BSZ 6		BSZ 8			BSZ 10			BSZ 12			BSZ 14		
Nominal embedment depth	h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Nominal drill bit diameter	d_0	[mm]	6		8			10			12			14		
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	6,40		8,45			10,45			12,50			14,50		
Effective anchorage depth	h_{ef}	[mm]	31	44	35	43	52	43	60	68	50	67	80	58	79	92
Depth of drill hole	$h_0 \geq$	[mm]	45	60	55	65	75	65	85	95	75	95	110	85	110	125
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	8		12			14			16			18		
Max. installation torque for screws with metric connection thread	$T_{inst} \leq$	[Nm]	10		20			40			60			80		
Tangential impact screw driver [1]	$T_{imp,max}$	[Nm]	160		300			400			650			650		

[1] Installation with tangential impact screw driver, with maximum power output $T_{imp,max}$ acc. to manufacturer's instructions is possible

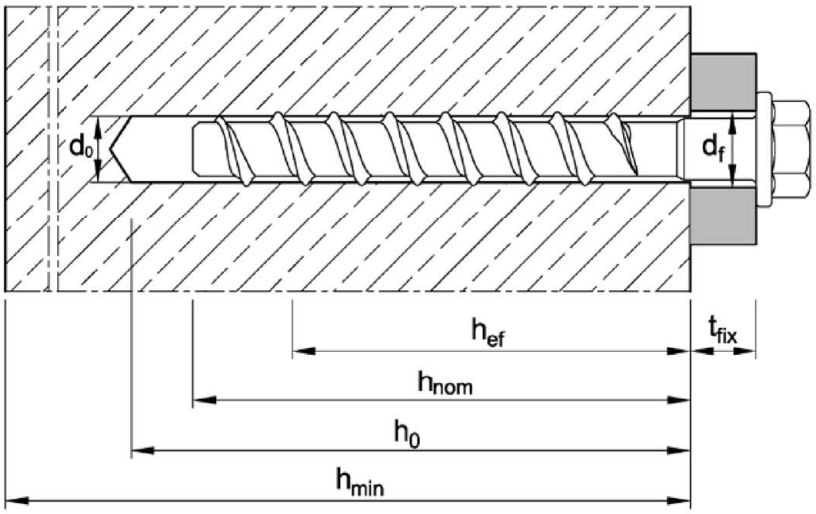


Table B2: Minimum thickness of member, minimum edge distance and minimum spacing

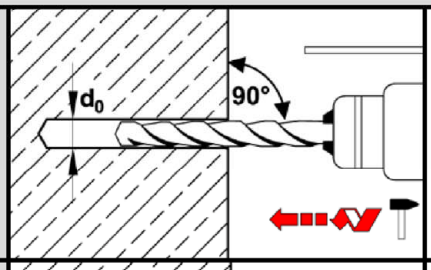
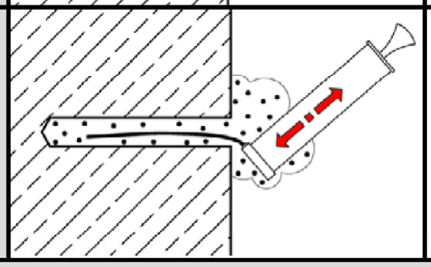
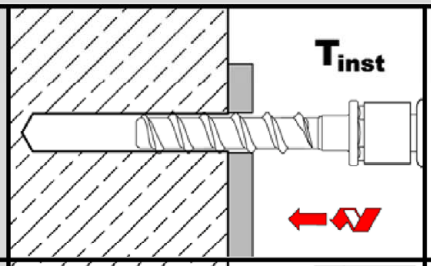
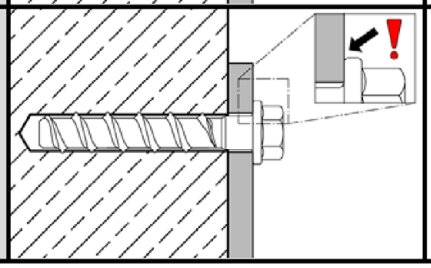
Anchor size			BSZ 6		BSZ 8			BSZ 10			BSZ 12			BSZ 14		
Nominal embedment depth	h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Minimum thickness of member	h_{min}	[mm]	80		80			80	90	102	80	101	120	87	119	138
Minimum spacing	s_{min}	[mm]	40		40	50		50			50		70	50	70	
Minimum edge distance	c_{min}	[mm]	40		40	50		50			50		70	50	70	

Concrete Screw BSZ

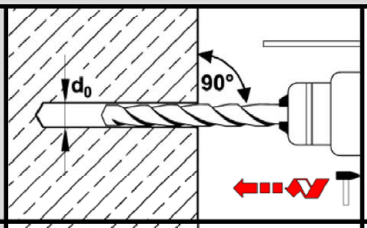
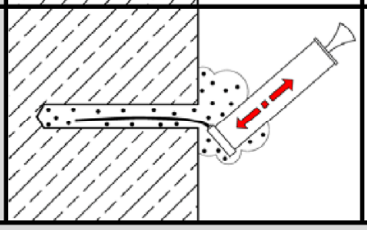
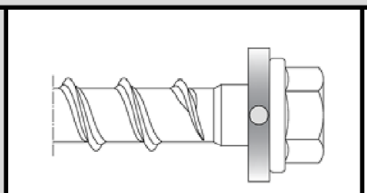
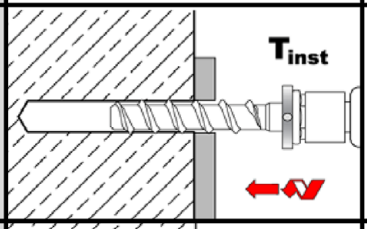
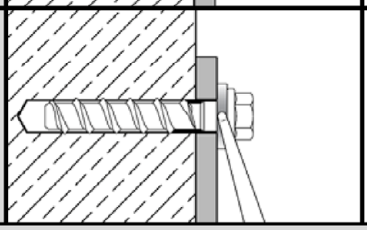
Intended use
Installation parameters / Minimum thickness of concrete member, minimum spacing and edge distance

Annex B2

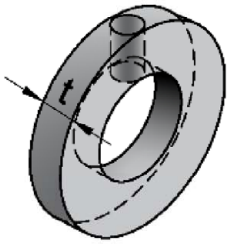
Installation instructions

Drill hole preparation and cleaning		
1		Drill hole perpendicular to concrete surface. Using a suction drill, continue with step 3.
2		Blow out dust or alternatively vacuum clean down to the bottom of the hole.
Installation concrete screw		
3		Screw in, e.g. with tangential impact screw driver or torque wrench.
4		After installation, the head of the anchor is supported on the fixture and must be undamaged.

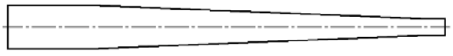
Installation instructions - filling of annular gap

Drill hole preparation and cleaning		
1		Drill hole perpendicular to concrete surface. Using a suction drill, continue with step 3.
2		Blow out dust or alternatively vacuum clean down to the bottom of the hole.
Installation concrete screw with filling washer		
3		Fit the filling washer to the concrete screw. The thickness of the filling washer must be taken into account with t_{fix}.
4		Screw in, e.g. with tangential impact screw driver or torque wrench.
5		Fill the annular gap between concrete screw and fixture with mortar (compressive strength ≥ 40 N/mm², e.g. Injection mortar VMH, VMZ or VMU plus). Use enclosed reducing adapter. Observe information on processing of the mortar! The annular gap is completely filled, when excess mortar seeps out.
For seismic loading, the application with and without filling of annular gap is permitted (Annex C3-C4).		

Filling washer and reducing adapter for filling the annular gap between concrete screw and fixture



thickness of filling washer
t = 5 mm



Concrete Screw BSZ

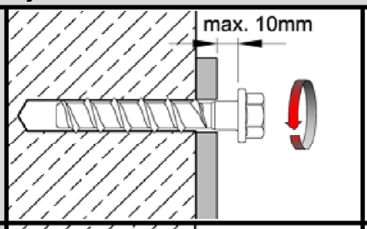
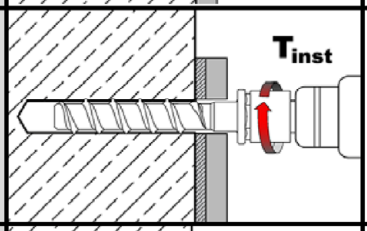
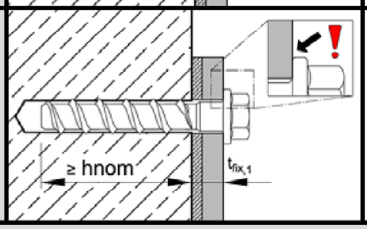
Intended use
Installation instructions with filling of annular gap

Annex B4

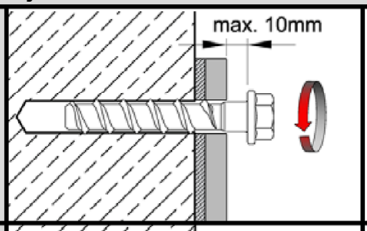
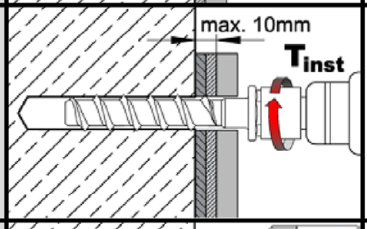
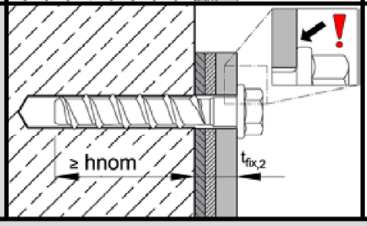
Installation instructions - Adjustment

Drill hole preparation and cleaning: Annex B3, Picture 1 and 2 / Installation: Annex B3, Picture 3 and 4

1. Adjustment

5		Screw may be untightened maximum 10mm.
6		After adjustment, screw in the concrete screw with tangential impact screw driver or torque wrench.
7		After installation, the head of the anchor is supported on the fixture must be undamaged.

2. Adjustment

8		Screw may be untightened maximum 10mm.
9		After adjustment, screw in the concrete screw with tangential impact screw driver or torque wrench.
10		After installation, the head of the anchor is supported on the fixture and must be undamaged.

- adjustment is permitted for fixings with concrete screws size BSZ 8 - BSZ 14, all anchorage depths
- the fastener may be adjusted max. 2x. The fastener must not be screwed back by more than 10mm in each case. The relining carried out during adjustment must not exceed 10 mm in total.
  Nominal embedment depth h_{nom} must still be maintained after the adjustment.

Concrete Screw BSZ

Intended use
Installation instructions - Adjustment

Annex B5

Table C1: Characteristic values for **static** or **quasi-static loads**

Anchor size				**BSZ 6**		**BSZ 8**			**BSZ 10**			**BSZ 12**			**BSZ 14**		
Nominal embedment depth		h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Installation factor		γ_{inst}	[-]	1,0													
Tension load																	
Steel failure																	
Characteristic resistance		$N_{Rk,s}$	[kN]	14		27			45			67			94		
Partial factor		$\gamma_{Ms,N}$	[-]	1,5													
Pull-out																	
Characteristic resistance in concrete C20/25	cracked	$N_{Rk,p}$	[kN]	2,0	4,0	5,0	9,0	12	9,0	≥ $N^0_{Rk,c}$ [1)]		12	≥ $N^0_{Rk,c}$ [1)]		≥ $N^0_{Rk,c}$ [1)]		
	uncracked	$N_{Rk,p}$	[kN]	4,0	9,0	7,5	12	16	12	20	26	16					
Increasing factor for $N_{Rk,p}$		Ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$													
Concrete cone failure																	
Effective anchorage depth		h_{ef}	[mm]	31	44	35	43	52	43	60	68	50	67	80	58	79	92
Spacing		$s_{cr,N}$	[mm]	3 h_{ef}													
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}													
Factor k_1	cracked	$k_{cr,N}$	[-]	7,7													
	uncracked	$k_{ucr,N}$	[-]	11,0													
Splitting																	
Characteristic resistance		$N^0_{Rk,sp}$	[kN]	min [$N^0_{Rk,c}$; $N_{Rk,p}$]													
Spacing		$s_{cr,sp}$	[mm]	120	160	120	140	150	140	180	210	150	210	240	180	240	280
Edge distance		$c_{cr,sp}$	[mm]	60	80	60	70	75	70	90	105	75	105	120	90	120	140
Shear load																	
Steel failure <u>without</u> lever arm																	
Characteristic resistance		$V^0_{Rk,s}$	[kN]	7,0		13,5		17,0	22,5	34,0		33,5	42,0		56,0		
Partial factor		$\gamma_{Ms,V}$	[-]	1,25													
Ductility factor		k_7	[-]	0,8													
Steel failure <u>with</u> lever arm																	
Characteristic bending resistance		$M^0_{Rk,s}$	[Nm]	10,9		26			56			113			185		
Concrete pry-out failure																	
Pry-out factor		k_8	[-]	1,0		1,0			1,0	2,0		1,0	2,0		1,0	2,0	
Concrete edge failure																	
Effective length of anchor		$l_f = h_{ef}$	[mm]	31	44	35	43	52	43	60	68	50	67	80	58	79	92
Outside diameter of anchor		d_{nom}	[mm]	6		8			10			12			14		

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

Table C2: Characteristic resistance for **seismic loading**, performance category **C1**

Anchor size			**BSZ 6**		**BSZ 8**	**BSZ 10**		**BSZ 12**	**BSZ 14**
Nominal embedment depth	h_{nom}	[mm]	40	55	65	55	85	100	115
Installation factor	γ_{inst}	[-]	1,0						
Tension load									
Steel failure									
Characteristic resistance	$N_{Rk,s,eq}$	[kN]	14		27	45		67	94
Partial factor	γ_{Ms}	[-]	1,5						
Pull-out									
Characteristic resistance	$N_{Rk,p,eq}$	[kN]	2,0	4,0	12	9,0	≥ $N^0_{Rk,c\ (C20/25)}$ [1]		
Concrete cone failure									
Effective anchorage depth	h_{ef}	[mm]	31	44	52	43	68	80	92
Spacing	$s_{cr,N}$	[mm]	$3h_{ef}$						
Edge distance	$c_{cr,N}$	[mm]	$1{,}5h_{ef}$						
Shear load									
Steel failure <u>without</u> lever arm									
Characteristic resistance	$V_{Rk,s,eq}$	[kN]	4,7	5,5	8,5	13,5	15,3	21,0	22,4
Partial factor	γ_{Ms}	[-]	1,25						
Concrete pry-out failure									
Pry-out factor	k_8	[-]	1,0			2,0			
Concrete edge failure									
Effective length of anchor	$l_f = h_{ef}$	[mm]	31	44	52	43	68	80	92
Outside diameter of anchor	d_{nom}	[mm]	6		8	10		12	14
Factor for annular gap **<u>with</u>** filling of annular gap	α_{gap}	[-]	1,0						
Factor for annular gap **<u>without</u>** filling of annular gap	α_{gap}	[-]	0,5						

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

Table C3: Characteristic resistance for **seismic loading**, performance category **C2,** **with filling of annular gap,** concrete screw BSZ zinc plated

Anchor size			**BSZ 8**	**BSZ 10**	**BSZ 12**	**BSZ 14**
Nominal embedment depth	h_{nom}	[mm]	65	85	100	115
Installation factor	γ_{inst}	[-]	1,0			
Tension load						
Steel failure						
Characteristic resistance	$N_{Rk,s.eq}$	[kN]	27	45	67	94
Partial factor	γ_{Ms}	[-]	1,5			
Pull-out						
Characteristic resistance	$N_{Rk,p,eq}$	[kN]	2,4	5,4	7,1	10,5
Concrete cone failure						
Effective anchorage depth	h_{ef}	[mm]	52	68	80	92
Spacing	$s_{cr,N}$	[mm]	$3h_{ef}$			
Edge distance	$c_{cr,N}$	[mm]	$1{,}5h_{ef}$			
Shear load						
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s.eq}$	[kN]	9,9	18,5	31,6	40,7
Partial factor	γ_{Ms}	[-]	1,25			
Concrete pry-out failure						
Pry-out factor	k_8	[-]	1,0	2,0		
Concrete edge failure						
Effective length of anchor	$l_f = h_{ef}$	[mm]	52	68	80	92
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	14
Factor for annular gap **with** filling of annular gap	α_{gap}	[-]	1,0			

Table C4: Characteristic resistance for **seismic loading**, performance category **C2,** **without filling of annular gap,** concrete screw BSZ zinc plated

Anchor size				**BSZ 8**	**BSZ 10**	**BSZ 12**	**BSZ 14**
Nominal embedment depth		h_{nom}	[mm]	65	85	100	115
Installation factor		γ_{inst}	[-]	1,0			
Tension loads							
Hexagon head	**Steel failure**						
	Characteristic resistance	$N_{Rk,s,eq}$	[kN]	27	45	67	94
	Partial factor	γ_{Ms}	[-]	1,5			
	Pull-out						
	Characteristic resistance	$N_{Rk,p,eq}$	[kN]	2,4	5,4	7,1	10,5
Countersunk head	**Steel failure**						
	Characteristic resistance	$N_{Rk,s,eq}$	[kN]	27	45	No performance assessed	
	Partial factor	γ_{Ms}	[-]	1,5		No performance assessed	
	Pull-out						
	Characteristic resistance	$N_{Rk,p,eq}$	[kN]	2,4	5,4	No performance assessed	
Concrete cone failure							
Effective anchorage depth		h_{ef}	[mm]	52	68	80	92
Spacing		$s_{cr,N}$	[mm]	3 h_{ef}			
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}			
Shear loads							
Steel failure <u>without</u> lever arm							
Hexagon head	Characteristic resistance	$V_{Rk,s,eq}$	[kN]	10,3	21,9	24,4	23,3
	Partial factor	γ_{Ms}	[-]	1,25			
Counter-sunk head	Characteristic resistance	$V_{Rk,s,eq}$	[kN]	3,6	13,7	No performance assessed	
	Partial factor	γ_{Ms}	[-]	1,25		No performance assessed	
Concrete pry-out failure							
Pry-out factor		k_8	[-]	1,0	2,0		
Concrete edge failure							
Effective length of anchor		$l_f = h_{ef}$	[mm]	52	68	80	92
Outside diameter of anchor		d_{nom}	[mm]	8	10	12	14
Factor for annular gap **<u>without</u>** filling of annular gap		α_{gap}	[-]	0,5			

Table C5: Characteristic values of resistance under **fire exposure**

Anchor size				**BSZ 6**		**BSZ 8**			**BSZ 10**			**BSZ 12**			**BSZ 14**		
Nominal anchorage depth		h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Steel failure (tension and shear resistance)																	
Characteristic resistance	R30	$N_{Rk,s,fi}$ = $V_{Rk,s,fi}$	[kN]	0,9		2,4			4,4			7,3			10,3		
	R60			0,8		1,7			3,3			5,8			8,2		
	R90			0,6		1,1			2,3			4,2			5,9		
	R120			0,4		0,7			1,7			3,4			4,8		
Steel failure <u>with</u> lever arm																	
Characteristic bending resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	0,7		2,4			5,9			12,3			20,4		
	R60			0,6		1,8			4,5			9,7			15,9		
	R90			0,5		1,2			3,0			7,0			11,6		
	R120			0,3		0,9			2,3			5,7			9,4		
Edge distance		$c_{cr,fi}$	[mm]	2 h_{ef}													
In case of fire attack from more than one side, the minimum edge distance shall be ≥ 300 mm																	
Spacing		$s_{cr,fi}$	[mm]	4 h_{ef}													
The characteristic resistance for pull-out, concrete cone failure, concrete pry-out and concrete edge failure shall be calculated according to EN 1992-4:2018.																	
The anchorage depth has to be increased for wet concrete by at least 30 mm compared to the given values																	

Table C6: Displacements under static or quasi-static loads

Anchor size				BSZ 6		BSZ 8			BSZ 10			BSZ 12			BSZ 14		
Nominal embedment depth		h_{nom}	[mm]	40	55	45	55	65	55	75	85	65	85	100	75	100	115
Tension load																	
cracked concrete	Tension load	N	[kN]	0,95	1,9	2,4	4,3	5,7	4,3	7,9	9,6	5,7	9,4	12,3	7,6	12,0	15,1
	Displacement	δ_{N0}	[mm]	0,3	0,6	0,6	0,7	0,8	0,6	0,5	0,9	0,9	0,5	1,0	0,5	0,8	0,7
		$\delta_{N\infty}$	[mm]	0,4	0,4	0,6	1,0	0,9	0,4	1,2	1,2	1,0	1,2	1,2	0,9	1,2	1,0
uncracked concrete	Tension load	N	[kN]	1,9	4,3	3,6	5,7	7,6	5,7	9,5	11,9	7,6	13,2	17,2	10,6	16,9	21,2
	Displacement	δ_{N0}	[mm]	0,4	0,6	0,7	0,9	0,5	0,7	1,1	1,0	1,0	1,1	1,2	0,9	1,2	0,8
		$\delta_{N\infty}$	[mm]	0,4	0,4	0,6	1,0	0,9	0,4	1,2	1,2	1,0	1,2	1,2	0,9	1,2	1,0
Shear load																	
Shear load		V	[kN]	3,3		8,6			16,2			20,0			30,5		
Displacement		δ_{V0}	[mm]	1,55		2,7			2,7			4,0			3,1		
		$\delta_{V\infty}$	[mm]	3,1		4,1			4,3			6,0			4,7		

Table C7: Displacements under **seismic loading**, performance category **C2** **with filling of annular gap,** concrete screw BSZ zinc plated

Anchor size			**BSZ 8**	**BSZ 10**	**BSZ 12**	**BSZ 14**
Nominal embedment depth	h_{nom}	[mm]	65	85	100	115
Tension load						
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
Shear load						
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 C8: Displacements under **seismic loading**, performance category **C2** **without filling of annular gap,** concrete screw BSZ zinc plated

Anchor size			**BSZ 8**	**BSZ 10**	**BSZ 12**	**BSZ 14**
Nominal embedment depth	h_{nom}	[mm]	65	85	100	115
Tension load						
Type with **hexagon head**						
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	2,26	4,39
Type with **countersunk head**						
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	No performance assessed	
Shear load						
Type with **hexagon head,** with clearance hole in the fixture						
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
Type with **countersunk head,** with clearance hole in the fixture						
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	No performance assessed	