

## DECLARAÇÃO DE DESEMPENHO

DoP número: MKT-125 - pt

- ✧ **Código de identificação único do produto-tipo:** Âncora de carga pesada SZ
- ✧ **Utilização(ões) prevista(s):** Âncoras mecânica para uso em concreto, ver Anexo B / Annex B
- ✧ **Fabricante:** MKT Metall-Kunststoff-Technik GmbH & Co.KG  
Auf dem Immel 2  
67685 Weilerbach
- ✧ **Sistemas de avaliação e verificação da regularidade:** 1
- ✧ **Documento de Avaliação Europeu** **EAD 330232-00-0601**  
Avaliação Técnica Europeia : **ETA-02/0030, 13.09.2019**  
Organismo de Avaliação Técnica: **DIBt, Berlin**  
Organismo(s) notificado (s): **NB 1343 – MPA, Darmstadt**

✧ **Desempenho(s) declarado(s):**

Características essenciais	Desempenho
<b>Resistência mecânica e estabilidade (BWR 1)</b>	
Resistências características sob carga de tração (efeitos estáticos e quase-estáticos)	Anexo / Annex C1 – C4
Resistências características sob tensão transversal (efeitos estáticos e quase-estáticos)	Anexo / Annex C5 – C6
Resistências características das categorias de desempenho sísmico C1 + C2	Anexo / Annex C7 – C8
Deslocamentos	Anexo / Annex C10 – C11
Durabilidade	Anexo / Annex B1
<b>Segurança contra incêndio (BWR 2)</b>	
Comportamento do fogo	Classe A1
Resistência ao fogo	Anexo / Annex C9

O desempenho do produto identificado acima está em conformidade com o conjunto de desempenhos declarados. A presente declaração de desempenho é emitida, em conformidade com o Regulamento (EU) n.º 305/2011, sob a exclusiva responsabilidade do fabricante identificado acima.

Assinado por e em nome do fabricante por:



**Stefan Weustenhagen**  
(Diretor-gerente)

**Weilerbach, 13.09.2019**

p.p.



**Dipl.-Ing. Detlef Bigalke**

(Director de Desenvolvimento de Produto)



O original desta declaração de desempenho foi escrito em alemão. Em caso de desvios na tradução, a versão alemã é válida.

## Specification of intended use

Highload Anchor SZ, steel zinc plated	10/M6	12/M8	15/M10	18/M12	24/M16	24/ M16L	28/M20	32/M24
Static or quasi-static action	✓							
Seismic action (SZ-B and SZ-S)	-	C1 + C2						
Seismic action (SZ-SK)	-	C1 + C2				-		
Fire exposure	R 30 ... R 120							
Highload Anchor SZ, stainless steel A4	12/M8	15/M10	18/M12	24/M16				
Static or quasi-static action	✓							
Seismic action (SZ-B and SZ-S)	C1 + C2							
Seismic action (SZ-SK)	C1 + C2			-				
Fire exposure	R30 ... R120							

### Base materials:

- Cracked and uncracked concrete
- Compacted, reinforced or unreinforced normal weight concrete (without fibers) according to EN 206:2013 + A1:2016
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016

### Use conditions (Environmental conditions):

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

Note: Particular aggressive conditions are e.g. permanent, alternating 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 de-icing 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 fastener is indicated on the design drawings (e.g. position of the fastener relative to reinforcement or to supports, etc.).
- Design according to EN 1992-4:2018 and Technical Report TR055

### Installation:

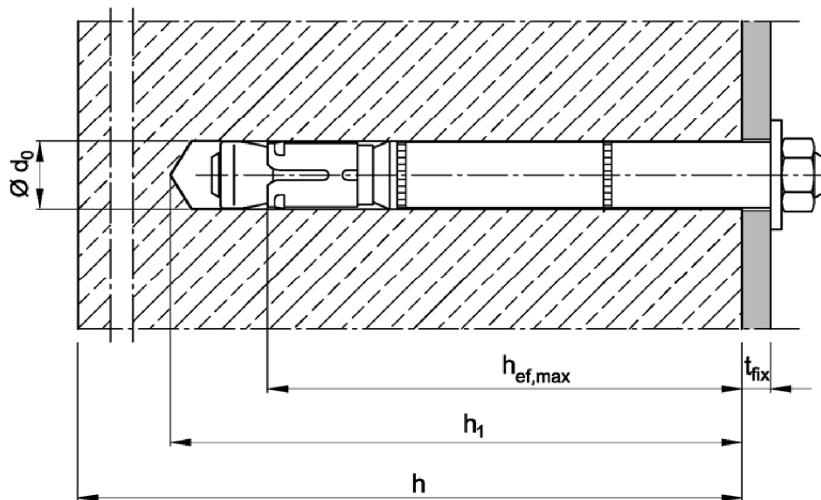
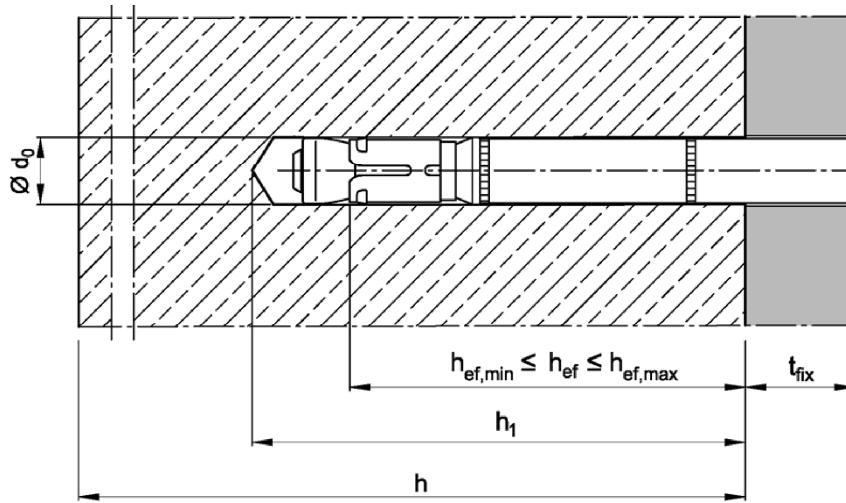
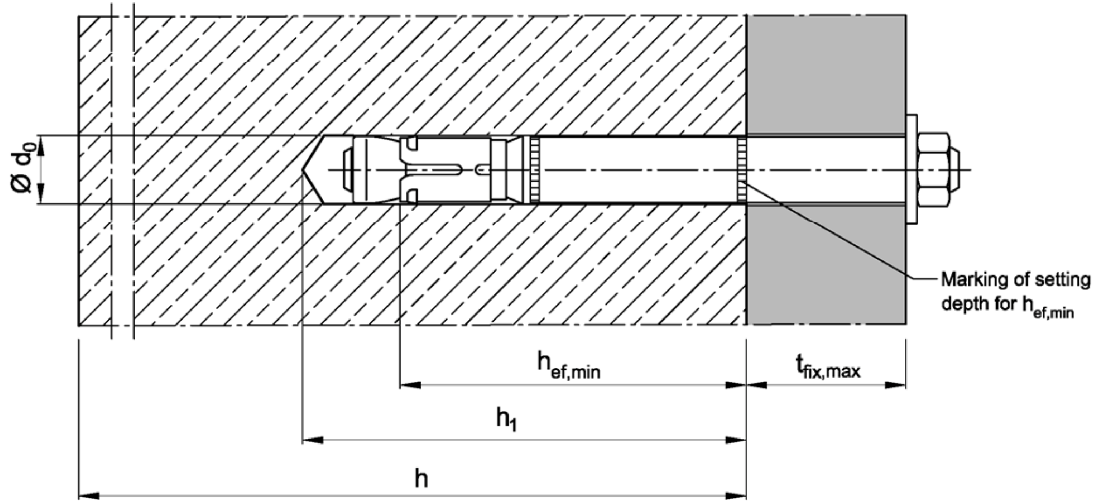
- Fastener installation carried out by appropriately qualified personnel and under the obligation of the person responsible for technical matters on site.
- Compliance with the effective anchorage depth. For fastenings with anchorage depths  $h_{ef} > h_{ef,min}$  the usable thickness of fixture is reduced by  $h_{ef} - h_{ef,min}$ .
- Use as supplied by the manufacturer without replacing individual parts.
- Drilling of hole only by hammer drilling (use of vacuum drill bits is admissible)

## Highload Anchor SZ

Intended use  
Specification of intended use

**Annex B1**

# Installation situation



**Highload Anchor SZ**

Intended use  
Installation situation

**Annex B2**

**Table B1: Installation parameters, steel zinc plated**

Fastener size		10/M6	12/M8	15/M10	18/M12	24/M16	24/ M16L	28/M20	32/M24
Size of thread	[-]	M6	M8	M10	M12	M16	M16	M20	M24
Minimum effective anchorage depth	$h_{ef,min}$ [mm]	50	60	71	80	100	115	125	150
Maximum effective anchorage depth	$h_{ef,max}$ [mm]	76	100	110	130	114	150	185	210
Nominal diameter of drill bit	$d_0 =$ [mm]	10	12	15	18	24	24	28	32
Cutting diameter of drill bit	$d_{cut} \leq$ [mm]	10,45	12,5	15,5	18,5	24,55	24,55	28,55	32,7
Depth of drill hole	$h_1 \geq$ [mm]	$h_{ef} + 15$	$h_{ef} + 20$	$h_{ef} + 24$	$h_{ef} + 25$	$h_{ef} + 30$	$h_{ef} + 30$	$h_{ef} + 35$	$h_{ef} + 30$
Diameter of clearance hole in the fixture	$d_f \leq$ [mm]	12	14	17	20	26	26	31	35
Thickness of countersunk washer SZ-SK	$t_{sk}$ [mm]	4	5	6	7	-	-	-	-
Minimum thickness of fixture SZ-SK	$t_{fix min}^{2)}$ [mm]	8	10	14	18	-	-	-	-
Installation torque	$T_{inst}$ (SZ-B, SZ-S) [Nm]	15	30	50	80	160	160	280	280
	$T_{inst}$ (SZ-SK) [Nm]	10	25	55	70	-	-	-	-
Minimum thickness of member	$h_{min}$ [mm]	$h_{ef} + 50$	$h_{ef} + 60$	$h_{ef} + 69$	$h_{ef} + 80$	$h_{ef} + 100$	$h_{ef} + 115$	$h_{ef} + 125$	$h_{ef} + 150$
Minimum spacing <sup>1) 3)</sup>	$s_{min}$ [mm]	50	50	60	70	100	100	125	150
cracked concrete	for $c \geq$ [mm]	50	80	120	140	180	180	300	300
Minimum edge distance <sup>1) 3)</sup>	$c_{min}$ [mm]	50	55	60	70	100	100	200	150
cracked concrete	for $s \geq$ [mm]	50	100	120	160	220	220	350	300
Minimum spacing <sup>1) 3)</sup>	$s_{min}$ [mm]	50	60	60	70	100	100	125	150
uncracked concrete	for $c \geq$ [mm]	80	100	120	140	180	180	300	300
Minimum edge distance <sup>1) 3)</sup>	$c_{min}$ [mm]	50	60	60	70	100	100	200	150
uncracked concrete	for $s \geq$ [mm]	100	120	120	160	220	220	350	300

<sup>1)</sup> Intermediate values by linear interpolation

<sup>2)</sup> Depending on the existing shear load, the thickness of the fixture may be reduced to the thickness of the countersunk washer  $t_{sk}$  (see Annex A2). It must be verified that the present shear load can be transferred completely into the distance sleeve (bearing of hole).

<sup>3)</sup> For fire exposure from more than one side  $c \geq 300$  mm or  $c_{min} \geq 300$  mm applies.

**Highload Anchor SZ**

**Intended use**  
Installation parameters, steel zinc plated

**Annex B3**

**Table B2: Installation parameters, stainless steel A4**

Fastener size			12/M8	15/M10	18/M12	24/M16
Size of thread		[-]	M8	M10	M12	M16
Minimum effective anchorage depth	$h_{ef,min}$	[mm]	60	71	80	100
Maximum effective anchorage depth	$h_{ef,max}$	[mm]	100	110	130	150
Nominal diameter of drill bit	$d_0 =$	[mm]	12	15	18	24
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	12,5	15,5	18,5	24,55
Depth of drill hole	$h_1 \geq$	[mm]	$h_{ef} + 20$	$h_{ef} + 24$	$h_{ef} + 25$	$h_{ef} + 30$
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	14	17	20	26
Thickness of countersunk washer SZ-SK	$t_{sk}$	[mm]	5	6	7	-
Minimum thickness of fixture SZ-SK	$t_{fix min}^{2)}$	[mm]	10	14	18	-
Installation torque	$T_{inst}$ (SZ-B)	[Nm]	35	55	90	170
	$T_{inst}$ (SZ-S)	[Nm]	30	50	80	170
	$T_{inst}$ (SZ-SK)	[Nm]	17,5	42,5	50	-
Minimum thickness of member	$h_{min}$	[mm]	$h_{ef} + 60$	$h_{ef} + 69$	$h_{ef} + 80$	$h_{ef} + 100$
Minimum spacing <sup>1) 3)</sup> cracked concrete	$s_{min}$	[mm]	50	60	70	80
	for $c \geq$	[mm]	80	120	140	180
Minimum edge distance <sup>1) 3)</sup> cracked concrete	$c_{min}$	[mm]	50	60	70	80
	for $s \geq$	[mm]	80	120	160	200
Minimum spacing <sup>1) 3)</sup> uncracked concrete	$s_{min}$	[mm]	50	60	70	80
	for $c \geq$	[mm]	80	120	140	180
Minimum edge distance <sup>1) 3)</sup> uncracked concrete	$c_{min}$	[mm]	50	85	70	180
	for $s \geq$	[mm]	80	185	160	80

<sup>1)</sup> Intermediate values by linear interpolation

<sup>2)</sup> Depending on the existing shear load, the thickness of the fixture may be reduced to the thickness of the countersunk washer  $t_{sk}$  (see Annex A2). It must be verified that the present shear load can be transferred completely into the distance sleeve (bearing of hole).

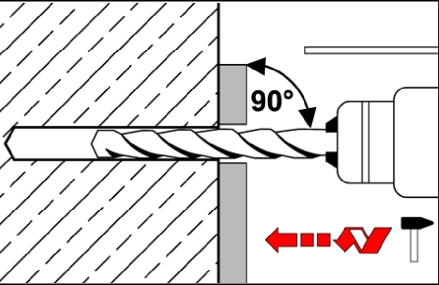
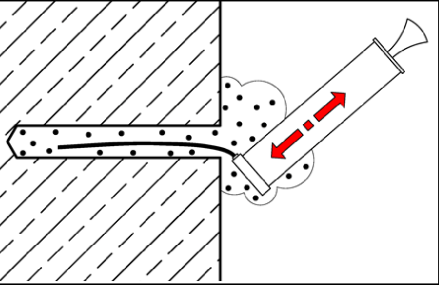
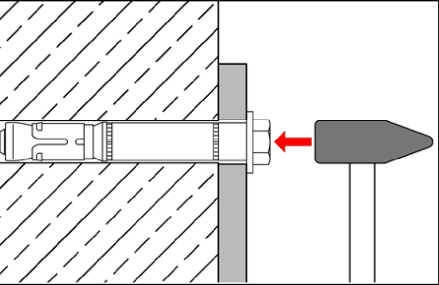
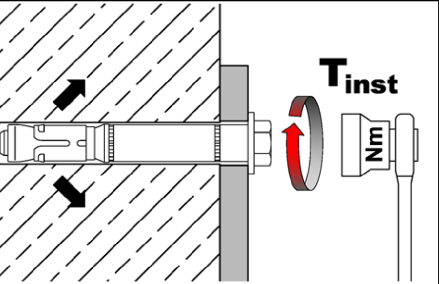
<sup>3)</sup> For fire exposure from more than one side  $c \geq 300$  mm or  $c_{min} \geq 300$  mm applies.

**Highload Anchor SZ**

**Intended use**  
Installation parameters, stainless steel A4

**Annex B4**

## Installation instructions

1		<p>Drill hole perpendicular to concrete surface. If using a vacuum drill bit, proceed with step 3.</p>
2		<p>Blow out dust. Alternatively vacuum clean down to the bottom of the hole.</p>
3		<p>Drive in fastener.</p>
4		<p>Apply installation torque <math>T_{inst}</math>.</p>

**Highload Anchor SZ**

**Intended use**  
Installation instructions

**Annex B5**

**Table C1: Characteristic values for tension load, cracked concrete, static or quasi-static action, steel zinc plated**

Fastener size			10/M6	12/M8	15/M10	18/M12	24/M16	24/ M16L	28/M20	32/M24
Installation factor	$\gamma_{inst}$	[-]	1,0							
<b>Steel failure</b>										
Characteristic resistance	$N_{Rk,s}$	[kN]	16	29	46	67	126	126	196	282
Partial factor	$\gamma_{Ms}$	[-]	1,5							
<b>Pull-out failure</b>										
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	5	12	16	25	36	44	50	65
Increasing factor for $N_{Rk,p}$	$\psi_C$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$							
<b>Concrete cone failure</b>										
Minimum effective anchorage depth	$h_{ef,min}$	[mm]	50	60	71	80	100	115	125	150
Maximum effective anchorage depth	$h_{ef,max}$	[mm]	76	100	110	130	114	150	185	210
Factor for cracked concrete	$k_1 = k_{cr,N}$	[-]	7,7							

**Highload Anchor SZ**

**Performance**

Characteristic values for **tension load, cracked concrete**, static or quasi-static action, **steel zinc plated**

**Annex C1**

**Table C2: Characteristic values for tension load, cracked concrete, static or quasi-static action, stainless steel A4**

Fastener size			12/M8	15/M10	18/M12	24/M16
Installation factor	$\gamma_{inst}$	[-]	1,0			
<b>Steel failure</b>						
<b>SZ-B</b>						
Characteristic resistance	$N_{Rk,s}$	[kN]	26	41	60	110
Partial factor	$\gamma_{Ms}$	[-]	1,5			
<b>SZ-S and SZ-SK</b>						
Characteristic resistance	$N_{Rk,s}$	[kN]	26	41	60	110
Partial factor	$\gamma_{Ms}$	[-]	1,87			
<b>Pull-out failure</b>						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	9	16	25	36
Increasing factor for $N_{Rk,p}$	$\psi_C$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$			
<b>Concrete cone failure</b>						
Minimum effective anchorage depth	$h_{ef,min}$	[mm]	60	71	80	100
Maximum effective anchorage depth	$h_{ef,max}$	[mm]	100	110	130	150
Factor for cracked concrete	$k_1 = k_{cr,N}$	[-]	7,7			

**Highload Anchor SZ**

**Performance**

Characteristic values for **tension load, cracked concrete**, static or quasi-static action, **stainless steel A4**

**Annex C2**



**Table C3: Characteristic values for tension load, uncracked concrete, static or quasi-static action, steel zinc plated**

Fastener size		10/M6	12/M8	15/M10	18/M12	24/M16	24/ M16L	28/M20	32/M24	
Installation factor	$\gamma_{inst}$ [-]	1,0								
<b>Steel failure</b>										
Characteristic resistance	$N_{Rk,s}$ [kN]	16	29	46	67	126	126	196	282	
Partial factor	$\gamma_{Ms}$ [-]	1,5								
<b>Pull-out failure</b>										
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$ [kN]	17	20	30	36	50	1)	70	1)	
Increasing factor for $N_{Rk,p}$	$\psi_C$ [-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$					-	$\left(\frac{f_{ck}}{20}\right)^{0,5}$		-
<b>Splitting failure</b> (The higher resistance of case 1 and case 2 may be applied)										
Case 1										
Characteristic resistance in uncracked concrete C20/25	$N^0_{Rk,sp}$ [kN]	12	16	25	30	40	70	50	70	
Edge distance	$c_{cr,sp}$ [mm]	1,5 $h_{ef}$								
Increasing factor for $N^0_{Rk,sp}$	$\psi_C$ [-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$								
Case 2										
Characteristic resistance in uncracked concrete	$N^0_{Rk,sp}$ [kN]	$\min(N_{Rk,p}; N^0_{Rk,c})$								
Edge distance	$c_{cr,sp}$ [mm]	2,5 $h_{ef}$					1,5 $h_{ef}$	2,5 $h_{ef}$	2 $h_{ef}$	
<b>Concrete cone failure</b>										
Minimum effective anchorage depth	$h_{ef,min}$ [mm]	50	60	71	80	100	115	125	150	
Maximum effective anchorage depth	$h_{ef,max}$ [mm]	76	100	110	130	114	150	185	210	
Edge distance	$c_{cr,N}$ [mm]	1,5 $h_{ef}$								
Factor for uncracked concrete	$k_1 = k_{ucr,N}$ [-]	11,0								

1)  $N_{Rk,p} = N^0_{Rk,c}$  calculated with  $h_{ef,min}$

### Highload Anchor SZ

#### Performance

Characteristic values for tension load, uncracked concrete, static or quasi-static action, steel zinc plated

**Annex C3**

**Table C4:** Characteristic values for **tension load, uncracked concrete, static or quasi-static action, stainless steel A4**

Fastener size			12/M8	15/M10	18/M12	24/M16
Installation factor	$\gamma_{inst}$	[-]	1,0			
<b>Steel failure</b>						
<b>SZ-B</b>						
Characteristic resistance	$N_{Rk,s}$	[kN]	26	41	60	110
Partial factor	$\gamma_{Ms}$	[-]	1,5			
<b>SZ-S and SZ-SK</b>						
Characteristic resistance	$N_{Rk,s}$	[kN]	26	41	60	110
Partial factor	$\gamma_{Ms}$	[-]	1,87			
<b>Pull-out failure</b>						
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	16	25	35	50
Increasing factor for $N_{Rk,p}$	$\psi_C$	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,5}$			
<b>Splitting failure</b>						
Edge distance	$c_{cr,sp}$	[mm]	180	235	265	300
<b>Concrete cone failure</b>						
Minimum effective anchorage depth	$h_{ef,min}$	[mm]	60	71	80	100
Maximum effective anchorage depth	$h_{ef,max}$	[mm]	100	110	130	150
Edge distance	$c_{cr,N}$	[mm]	$1,5 h_{ef}$			
Factor for uncracked concrete	$k_1 = k_{ucr,N}$	[-]	11,0			

**Highload Anchor SZ**

**Performance**

Characteristic values for **tension loads, uncracked concrete, static or quasi-static action, stainless steel A4**

**Annex C4**

**Table C5: Characteristic values of shear load, static or quasi-static action, steel zinc plated**

Fastener size			10/M6	12/M8	15/M10	18/M12	24/M16	24/ M16L	28/M20	32/M24
<b>Steel failure without lever arm</b>										
<b>SZ-B</b>										
Characteristic resistance	$V_{Rk,s}^0$	[kN]	16	25	36	63	91	91	122	200
Ductility factor	$k_7$	[-]	1,0							
Partial factor	$\gamma_{Ms}$	[-]	1,25							
<b>SZ-S and SZ-SK</b>										
Characteristic resistance	$V_{Rk,s}^0$	[kN]	18	30	48	73	126	126	150	200
Ductility factor	$k_7$	[-]	1,0							
Partial factor	$\gamma_{Ms}$	[-]	1,25							
<b>Steel failure with lever arm</b>										
<b>SZ-B, SZ-S und SZ-SK</b>										
Anchorage depth	$h_{ef,min} \geq$	[mm]	50	60	71	80	100	115	125	150
Characteristic bending resistance	$M_{Rk,s}^0$	[Nm]	12	30	60	105	266	266	519	898
Partial factor	$\gamma_{Ms}$	[-]	1,25							
Anchorage depth	$h_{ef} \geq$	[mm]	64	73	90	106	138	138	158	188
Characteristic bending resistance	$M_{Rk,s}^0$	[Nm]	40	58	119	234	529	529	847	1343
Partial factor	$\gamma_{Ms}$	[-]	1,25							
<b>Concrete pry-out failure</b>										
Pry-out factor	$k_8$	[-]	1,8 <sup>1)</sup>	2,0						
<b>Concrete edge failure</b>										
Effective length of fastener in shear loading	$l_f$	[mm]	$h_{ef}$							
Outside diameter of fastener	$d_{nom}$	[mm]	10	12	15	18	24	24	28	32

<sup>1)</sup>  $k_8 = 2,0$  for  $h_{ef} \geq 60$  mm

**Highload Anchor SZ**

**Performance**  
Characteristic values for **shear load**, static or quasi-static action, **steel zinc plated**

**Annex C5**

**Table C6:** Characteristic values for **shear load**, static or quasi-static action, **stainless steel A4**

Fastener size			12/M8	15/M10	18/M12	24/M16
<b>Steel failure without lever arm</b>						
Characteristic resistance	$V_{Rk,s}^0$	[kN]	24	37	62	92
<b>SZ-B</b>						
Ductility factor	$k_7$	[-]	1,0			
Partial factor	$\gamma_{Ms}$	[-]	1,25			
<b>SZ-S</b>						
Ductility factor	$k_7$	[-]	1,0			
Partial factor	$\gamma_{Ms}$	[-]	1,36			
<b>SZ-SK</b>						
Ductility factor	$k_7$	[-]	0,8			-
Partial factor	$\gamma_{Ms}$	[-]	1,36			-
<b>Steel failure with lever arm</b>						
Anchorage depth	$h_{ef,min} \geq$	[mm]	60	71	80	100
Characteristic bending resistance	$M_{Rk,s}^0$	[Nm]	26	52	92	232
<b>SZ-B</b>						
Partial factor	$\gamma_{Ms}$	[-]	1,25			
<b>SZ-S and SZ-SK</b>						
Partial factor	$\gamma_{Ms}$	[-]	1,56			
<b>SZ-B, SZ-S and SZ-SK</b>						
Anchorage depth	$h_{ef} \geq$	[mm]	73	90	106	138
Characteristic bending resistance	$M_{Rk,s}^0$	[Nm]	103	211	374	847
Partial factor	$\gamma_{Ms}$	[-]	1,25			
<b>Concrete pry-out failure</b>						
Pry-out factor	$k_8$	[-]	2,0			
<b>Concrete edge failure</b>						
Effective length of fastener in shear loading	$l_f$	[mm]	$h_{ef}$			
Outside diameter of fastener	$d_{nom}$	[mm]	12	15	18	24

**Highload Anchor SZ**

**Performance**  
 Characteristic values for **shear load**, static or quasi-static action,  
**stainless steel A4**

**Annex C6**

**Table C7: Characteristic values for seismic action, Category C1 and C2, steel zinc plated**

Fastener size			12/M8	15/M10	18/M12	24/M16	24/M16L	28/M20	32/M24	
Tension load										
Installation factor		$\gamma_{inst}$	[-]		1,0					
<b>Steel failure</b>										
Characteristic resistance category C1		$N_{Rk,s,eq,C1}$	[kN]	29	46	67	126	126	196	282
Characteristic resistance category C2		$N_{Rk,s,eq,C2}$	[kN]	29	46	67	126	126	196	282
Partial factor		$\gamma_{Ms}$	[-]		1,5					
<b>Pull-out failure</b>										
Characteristic resistance category C1		$N_{Rk,p,eq,C1}$	[kN]	12	16	25	36	44,4	50,3	63,3
Characteristic resistance category C2		$N_{Rk,p,eq,C2}$	[kN]	5,4	16,4	22,6	29,0	41,2	43,6	63,3
<b>Shear load</b>										
<b>Steel failure without lever arm</b>										
<b>SZ-B</b>										
Characteristic resistance category C1		$V_{Rk,s,eq,C1}$	[kN]	18,0	27,1	43,4	51,9	51,9	96,4	160,1
Characteristic resistance category C2		$V_{Rk,s,eq,C2}$	[kN]	12,7	20,5	31,5	50,1	50,1	67,1	108,1
<b>SZ-S</b>										
Characteristic resistance category C1		$V_{Rk,s,eq,C1}$	[kN]	18,0	27,1	43,4	51,9	51,9	96,4	160,1
Characteristic resistance category C2		$V_{Rk,s,eq,C2}$	[kN]	12,7	20,5	31,5	69,3	69,3	67,1	108,1
<b>SZ-SK</b>										
Characteristic resistance category C1		$V_{Rk,s,eq,C1}$	[kN]	25,2	36,5	50,4	-	-	-	-
Characteristic resistance category C2		$V_{Rk,s,eq,C2}$	[kN]	19,2	29,3	39,4	-	-	-	-
Factor for annular gap		$\alpha_{gap}$	[-]		0,5					
Partial factor		$\gamma_{Ms}$	[-]		1,25					

**Highload Anchor SZ**

**Performance**  
Characteristic values for seismic action, steel zinc plated

**Annex C7**

**Table C8: Characteristic values for seismic action, Category C1 and C2, stainless steel A4**

Fastener size			12/M8	15/M10	18/M12	24/M16
<b>Tension load</b>						
Installation factor	$\gamma_{inst}$	[-]	1,0			
<b>Steel failure</b>						
Characteristic resistance, category C1	$N_{Rk,s,eq,C1}$	[kN]	26	41	60	110
Characteristic resistance, category C2	$N_{Rk,s,eq,C2}$	[kN]	26	41	60	110
Partial factor <b>SZ-B</b>	$\gamma_{Ms}$	[-]	1,5			
Partial factor <b>SZ-S and SZ-SK</b>	$\gamma_{Ms}$	[-]	1,87			
<b>Pull-out failure</b>						
Characteristic resistance, category C1	$N_{Rk,p,eq,C1}$	[kN]	9	16	26	36
Characteristic resistance, category C2	$N_{Rk,p,eq,C2}$	[kN]	4,8	16,5	24,8	44,5
<b>Shear load</b>						
<b>Steel failure without lever arm</b>						
<b>SZ-B</b>						
Characteristic resistance, category C1	$V_{Rk,s,eq,C1}$	[kN]	9,6	13,3	25,4	75,4
Characteristic resistance, category C2	$V_{Rk,s,eq,C2}$	[kN]	9,7	14,0	18,0	32,2
Partial factor	$\gamma_{Ms}$	[-]	1,25			
<b>SZ-S</b>						
Characteristic resistance, category C1	$V_{Rk,s,eq,C1}$	[kN]	9,6	13,3	25,4	75,4
Characteristic resistance, category C2	$V_{Rk,s,eq,C2}$	[kN]	9,7	14,0	18,0	32,2
Partial factor	$\gamma_{Ms}$	[-]	1,36			
<b>SZ-SK</b>						
Characteristic resistance, category C1	$V_{Rk,s,eq,C1}$	[kN]	11,5	23,3	31,6	-
Characteristic resistance, category C2	$V_{Rk,s,eq,C2}$	[kN]	10,8	17,4	15,4	-
Partial factor	$\gamma_{Ms}$	[-]	1,36			
Factor for annular gap	$\alpha_{gap}$	[-]	0,5			

**Highload Anchor SZ**

**Performance**  
Characteristic values for seismic action, stainless steel A4

**Annex C8**

**Table C9:** Characteristic values under **fire exposure** in cracked and uncracked concrete C20/25 to C50/60

Fastener size		10/M6	12/M8	15/M10	18/M12	24/M16	24/ M16L	28/M20	32/M24	
<b>Tension load</b>										
<b>Steel failure</b>										
<b>Steel zinc plated</b>										
Characteristic resistance	R30	$N_{Rk,s,fi}$ [kN]	1,0	1,9	4,3	6,3	11,6	18,3	26,3	
	R60		0,8	1,5	3,2	4,6	8,6	13,5	19,5	
	R90		0,6	1,0	2,1	3,0	5,0	7,7	12,6	
	R120		0,4	0,8	1,5	2,0	3,1	4,9	9,2	
<b>Stainless steel A4</b>										
Characteristic resistance	R30	$N_{Rk,s,fi}$ [kN]	-	6,1	10,2	15,7	29,2	-	-	-
	R60		-	4,4	7,3	11,1	20,6	-	-	-
	R90		-	2,6	4,3	6,4	12,0	-	-	-
	R120		-	1,8	2,8	4,1	7,7	-	-	-
<b>Shear load</b>										
<b>Steel failure without lever arm</b>										
<b>Steel zinc plated</b>										
Characteristic resistance	R30	$V_{Rk,s,fi}$ [kN]	1,0	1,9	4,3	6,3	11,6	18,3	26,3	
	R60		0,8	1,5	3,2	4,6	8,6	13,5	19,5	
	R90		0,6	1,0	2,1	3,0	5,0	7,7	12,6	
	R120		0,4	0,8	1,5	2,0	3,1	4,9	9,2	
<b>Stainless steel A4</b>										
Characteristic resistance	R30	$V_{Rk,s,fi}$ [kN]	-	14,3	22,7	32,8	61,0	-	-	-
	R60		-	11,1	17,6	25,5	47,5	-	-	-
	R90		-	7,9	12,6	18,3	34,0	-	-	-
	R120		-	6,3	10,0	14,6	27,2	-	-	-
<b>Steel failure with lever arm</b>										
<b>Steel zinc plated</b>										
Characteristic bending resistance	R30	$M^0_{Rk,s,fi}$ [Nm]	0,8	2,0	5,6	9,7	24,8	42,4	83,6	
	R60		0,6	1,5	4,1	7,2	18,3	29,8	61,9	
	R90		0,4	1,0	2,7	4,7	11,9	17,1	40,1	
	R120		0,3	0,8	1,9	3,1	6,6	10,7	29,2	
<b>Stainless steel A4</b>										
Characteristic bending resistance	R30	$M^0_{Rk,s,fi}$ [Nm]	-	6,2	13,2	24,4	61,8	-	-	-
	R60		-	4,5	9,4	17,2	43,6	-	-	-
	R90		-	2,7	5,6	10,0	25,3	-	-	-
	R120		-	1,8	3,6	6,4	16,2	-	-	-

**Highload Anchor SZ**

**Performance**  
Characteristic values under **fire exposure**

**Annex C9**

**Table C10: Displacements under tension and shear load, steel zinc plated**

Fastener size			10/ M6	12/ M8	15/ M10	18/ M12	24/ M16	24 /M16L	28/ M20	32/ M24
<b>Tension load</b>										
Tension load in cracked concrete	N	[kN]	2,4	5,7	7,6	12,3	17,1	21,1	24	26,2
Displacement	$\delta_{N0}$	[mm]	0,5	0,5	0,5	0,7	0,8	0,7	0,9	1,4
	$\delta_{N\infty}$	[mm]	2,0	2,0	1,3	1,3	1,3	1,3	1,4	1,9
Tension load in uncracked concrete	N	[kN]	8,5	9,5	14,3	17,2	24	29,6	34	43
Displacement	$\delta_{N0}$	[mm]	0,8	1,0	1,1		1,3		0,3	0,7
	$\delta_{N\infty}$	[mm]	3,4		1,7		2,3		1,4	0,7
<b>Seismic action C2</b>										
Displacement for DLS	$\delta_{N,eq}$ (DLS)	[mm]	-	3,3	3,0	5,0	3,0	3,0	4,0	5,3
Displacement for ULS	$\delta_{N,eq}$ (ULS)	[mm]	-	12,2	11,3	16,0	9,2	9,2	13,8	12,4
<b>Shear load</b>										
<b>SZ-B</b>										
Shear load in cracked and uncracked concrete	V	[kN]	9,1	14	20,7	35,1	52,1	52,1	77	86,6
Displacement	$\delta_{V0}$	[mm]	2,5	2,1	2,7	3,0	5,1	5,1	4,3	10,5
	$\delta_{V\infty}$	[mm]	3,8	3,1	4,1	4,5	7,6	7,6	6,5	15,8
<b>Seismic action C2</b>										
Displacement for DLS	$\delta_{V,eq}$ (DLS)	[mm]	-	2,3	3,1	3,0	2,6	2,6	1,6	6,1
Displacement for ULS	$\delta_{V,eq}$ (ULS)	[mm]	-	4,8	6,4	6,1	6,6	6,6	4,8	9,5
<b>SZ-S</b>										
Shear load in cracked and uncracked concrete	V	[kN]	10,1	17,1	27,5	41,5	72	72	77	86,6
Displacement	$\delta_{V0}$	[mm]	2,9	2,5	3,6	3,5	7,0	7,0	4,3	10,5
	$\delta_{V\infty}$	[mm]	4,4	3,8	5,4	5,3	10,5	10,5	6,5	15,8
<b>Seismic action C2</b>										
Displacement for DLS	$\delta_{V,eq}$ (DLS)	[mm]	-	2,3	3,1	3,0	3,3	3,3	1,6	6,1
Displacement for ULS	$\delta_{V,eq}$ (ULS)	[mm]	-	4,8	6,4	6,1	8,2	8,2	4,8	9,5
<b>SZ-SK</b>										
Shear load in cracked and uncracked concrete	V	[kN]	10,1	17,1	27,5	41,5	-	-	-	-
Displacement	$\delta_{V0}$	[mm]	2,9	2,5	3,6	3,5	-	-	-	-
	$\delta_{V\infty}$	[mm]	4,4	3,8	5,4	5,3	-	-	-	-
<b>Seismic action C2</b>										
Displacement for DLS	$\delta_{V,eq}$ (DLS)	[mm]	-	3,1	3,9	3,9	-	-	-	-
Displacement for ULS	$\delta_{V,eq}$ (ULS)	[mm]	-	10,2	11,8	13,0	-	-	-	-

**Highload Anchor SZ**

**Performance**  
Displacements under tension and shear load, steel zinc plated

**Annex C10**



**Table C11: Displacements under tension and shear load, stainless steel A4**

Fastener size		12/M8	15/M10	18/M12	24/M16	
<b>Tension load</b>						
Tension load in cracked concrete	N	[kN]	4,3	7,6	12,1	17,0
Displacement	$\delta_{N0}$	[mm]	0,5	0,5	1,3	0,5
	$\delta_{N\infty}$	[mm]	1,2	1,6	1,8	1,6
Tension load in uncracked concrete	N	[kN]	7,6	11,9	16,7	24,1
Displacement	$\delta_{N0}$	[mm]	0,2	0,3	1,2	1,5
	$\delta_{N\infty}$	[mm]	1,1	1,1	1,1	1,1
Seismic action C2						
Displacement for DLS	$\delta_{N,eq (DLS)}$	[mm]	4,7	4,5	4,3	4,9
Displacement for ULS	$\delta_{N,eq (ULS)}$	[mm]	13,3	12,7	9,7	10,1
<b>Shear load</b>						
Shear load in cracked concrete	V	[kN]	13,9	21,1	34,7	50,8
Displacement	$\delta_{V0}$	[mm]	3,4	4,9	4,8	6,7
	$\delta_{V\infty}$	[mm]	5,1	7,4	7,1	10,1
Seismic action C2						
<b>SZ-B and SZ-S</b>						
Displacement for DLS	$\delta_{V,eq (DLS)}$	[mm]	2,8	3,1	2,6	3,3
Displacement for ULS	$\delta_{V,eq (ULS)}$	[mm]	5,6	5,8	5,0	6,9
<b>SZ-SK</b>						
Displacement for DLS	$\delta_{V,eq (DLS)}$	[mm]	2,5	2,8	2,9	-
Displacement for ULS	$\delta_{V,eq (ULS)}$	[mm]	5,8	5,9	6,9	-

**Highload Anchor SZ**

**Performance**  
Displacements under tension and shear load, **stainless steel A4**

**Annex C11**