PROHLÁŠENÍ O VLASTNOSTECH
DoP Nr. MKT-312 - cz

1. Jedinečný identifikační kód typu výrobku: **MKT Chemická kotva VMZ a VMZ-IG**

2. Typ, série nebo sériové číslo nebo jakýkoli jiný prvek umožňující identifikaci stavebních výrobků podle čl. 11 odst. 4:

   ETA-04/0092, Annex A3 & A5
   Číslo šarže: viz obal výrobku

3. Zamýšlené použití nebo zamýšlená použití stavebního výrobku v souladu s příslušnou harmonizovanou technickou specifikací podle předpokladu výrobce:

Obecný typ	Vlepovaná chemická kotva s kontrolovatelným utahovacím momentem
Použití	Trhlinový nebo netrhlinový beton C20/25 - C50/60 (EN 206)
Úroveň / kategorie	1
Zatížení	Statické nebo kvazi-statické, zemětřesení kategorie (Velikosti VMZ: M10, M12, M16, M20, M24)

Materiál	Galvanicky pozinkovaná ocel nebo Diffusion pozinkované:
	 Pouze pro suché vnitřní prostředí
	 Rozměrová řada: VMZ: M8, M10, M12, M16, M20, M24
	
	 Diffusion pozinkované ocel :
	 Pouze pro suché vnitřní prostředí
	 Rozměrová řada: VMZ-IG: M6, M8, M10, M12, M16, M20
	
	 Pozinkovaná ocel:
	 Pouze pro suché vnitřní prostředí
	 Rozměrová řada: VMZ: M8, M10, M12, M16, M20, M24
	                           VMZ-IG: M6, M8, M10, M12, M16, M20
	
	 Nerezová ocel (značení A4):
	 Pro vnitřní i venkovní použití mimo specifické agresivní podmínky
	 Rozměrová řada: VMZ: M8, M10, M12, M16, M20, M24
	                           VMZ-IG: M6, M8, M10, M12, M16, M20
	
	 Vysoce odolná ocel vůči korozi (označení HCR):
	 Pro vnitřní i venkovní použití mimo specifické agresivní podmínky
	 Rozměrová řada: VMZ: M8, M10, M12, M16, M20, M24
	                           VMZ-IG: M6, M8, M10, M12, M16, M20

Teplotní rozsah (pokud to je relevantní)	Rozsah I: -40 °C - +80 °C Rozsah II: -40 °C - +120 °C

4. Jméno, firma nebo registrovaná obchodní známka a kontaktní adresa výrobce podle čl. 11 odst. 5:

   MKT Metall-Kunststoff-Technik GmbH & Co. KG
   Auf dem Immel 2
   D - 67685 Weilerbach

5. Případně jméno a kontaktní adresa zplnomocněného zástupce, jehož plná moc se vztahuje na úkoly uvedené v čl. 12 odst. 2:   --

6. Systém nebo systémy posuzování a ověřování stálosti vlastností stavebních výrobků, jak je uvedeno v příloze V: **Systém 1**

7. V případě prohlášení o vlastnostech týkajících se stavebního výrobku, na který se vztahuje harmonizovaná norma

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8. V případě prohlášení o vlastnostech týkajících se stavebního výrobku, pro který bylo vydáno evropské technické posouzení:

Deutsches Institut für Bautechnik, Berlin

vydal:

ETA-04/0092

na základě

ETAG 001-5

Oznámený subjekt 1343-CPR provedl podle systému 1:

i) určení typu výrobku na základě zkoušky typu (včetně odběru vzorků), výpočtu pro typ, tabulkových hodnot nebo popisné dokumentace výrobku
ii) počáteční inspekce ve výrobním závodě a řízení výroby
iii) průběžného dozoru, posouzení a hodnocení řízení výroby

Na základě: osvědčení o stálosti vlastností 1343-CPR-M 550-4/08.14

9. Deklarované vlastnosti:

Základní charakteristiky	Návrhová metoda	Provedení		Harmonizovaná technická specifikace
		VMZ-A	**VMZ-IG**	
Charakteristická únosnost pro tahové napětí	ETAG 001, Annex C CEN/TS 1992-4	Annex C1-C3	Annex C10, C11	ETAG 001
Charakteristická únosnost pro smykové napětí	ETAG 001, Annex C CEN/TS 1992-4	Annex C4, C5	Annex C12	
Charakteristická únosnost pro seizmické zatížení	TR 045	Annex C6, C7	--	
Posun kotvy při mezních stavech	ETAG 001, Annex C CEN/TS 1992-4	Annex C8, C9	Annex C12	

Pokud byla použita podle článku 37 nebo 38 specifická technická dokumentace, požadavky, které výrobek splňuje: --

10. Vlastnost výrobku uvedená v bodě 1 a 2 je ve shodě s vlastností uvedenou v bodě 9.

Toto prohlášení o vlastnostech se vydává na výhradní odpovědnost výrobce uvedeného v bodě 4.

Podepsáno za výrobce a jeho jménem:

Stefan Weustenhagen
(Managing Director)
Weilerbach, 13.04.2017

i.V.

Dipl.-Ing. Detlef Bigalke
(Head of Product Development)

13.04.2017

Table C1: Characteristic values for **tension loads, VMZ-A M8 – M12**, **cracked concrete**, static and quasi-static action

Anchor size VMZ-A			40 M8	50 M8	60 M10	75 M10	75 M12	70 M12	80 M12	95 M12	100 M12	110 M12	125 M12
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0										
Steel failure													
Characteristic tension resistance $N_{Rk,s}$	Steel, zinc plated	[kN]	15	18	25		35	49	54		57		
	A4, HCR	[kN]	15	18	25		35	49	54		57		
Partial safety factor	γ_{Ms}	[-]	1,5										
Pull-out													
Characteristic resistance $N_{Rk,p}$ in concrete C20/25	50°C / 80°C[2]	[kN]	1)										
	72°C / 120°C[2]	[kN]	5	7,5	12	12	12	16	20	20	30	30	30
Increasing factor	ψ_C	[-]	$\left(\dfrac{f_{ck,cube}}{25}\right)^{0,5}$										
Concrete cone failure													
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	50	60	75	75	70	80	95	100	110	125
Factor acc. to CEN/TS 1992-4	k_{cr}	[-]	7,2										

1) Pull-out failure is not decisive
2) Maximum long term temperature / Maximum short term temperature

Table C2: Characteristic values for **tension loads, VMZ-A M16 – M24**, **cracked concrete**, static and quasi-static action

Anchor size VMZ-A			90 M16	105 M16	125 M16	145 M16	160 M16	115 M20	170 M20 (LG)	190 M20 (LG)	170 M24 (LG)	200 M24 (LG)	225 M24 (LG)
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0										
Steel failure													
Characteristic tension resistance $N_{Rk,s}$	Steel, zinc plated	[kN]	88	95	111		97	96	188		222		
	A4, HCR	[kN]	88	95	111		97	114	165		194		
Partial safety factor	γ_{Ms}	[-]	1,5					1,68	1,5		1,5		
Pull-out													
Characteristic resistance $N_{Rk,p}$ in concrete C20/25	50°C / 80°C[2]	[kN]	1)										
	72°C / 120°C[2]	[kN]	25	30	50		51	30	60		75		
Increasing factor	ψ_C	[-]	$\left(\dfrac{f_{ck,cube}}{25}\right)^{0,5}$										
Concrete cone failure													
Effective anchorage depth	$h_{ef} \geq$	[mm]	90	105	125	145	160	115	170	190	170	200	225
Factor acc. to CEN/TS 1992-4	k_{cr}	[-]	7,2										

1) Pull-out failure is not decisive
2) Maximum long term temperature / Maximum short term temperature

Injection System VMZ	
Performance Characteristic values for **tension loads, VMZ-A** in **cracked concrete**, static and quasi-static action	**Annex C1**

Table C3: Characteristic values for **tension loads, VMZ-A M8 – M12** in **uncracked concrete**, static and quasi-static action

Anchor size VMZ-A			40 M8	50 M8	60 M10	75 M10	75 M12	70 M12	80 M12	95 M12	100 M12	110 M12	125 M12
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0										
Steel failure													
Characteristic tension resistance $N_{Rk,s}$	Steel, zinc plated	[kN]	15	18	25		35	49	54		57		
	A4, HCR	[kN]	15	18	25		35	49	54		57		
Partial safety factor	γ_{Ms}	[-]	1,5										
Pull-out													
Characteristic resistance $N_{Rk,p}$ in uncracked concrete C20/25	50°C / 80°C[2]	[kN]	9	1)	1)		1)			40	1)	50	50
	72°C / 120°C[2]	[kN]	6	9	16		16	16	25	25	30	30	30
Splitting													
Splitting for **standard thickness of concrete member** (The higher resistance of Case 1 and Case 2 may be applied.)													
Standard thickness of concrete	$h_{std} \geq 2\,h_{ef}$	[mm]	100		120	150	150	140	160	190	200	220	250
Case 1 ($N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$)													
Characteristic resistance in uncracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	7,5	9	16	20	20	20	1)	30	40	40	40
Spacing (edge distance)	$s_{cr,sp}\ (= 2\,c_{cr,sp})$	[mm]	3 h_{ef}										
Case 2													
Spacing (edge distance)	$s_{cr,sp}\ (= 2\,c_{cr,sp})$	[mm]	6 h_{ef}		5 h_{ef}	7 h_{ef}	7 h_{ef}	5 h_{ef}	3 h_{ef}	5 h_{ef}	4 h_{ef}	6 h_{ef}	5 h_{ef}
Splitting for **minimum thickness of concrete member** (The higher resistance of Case 1 and Case 2 may be applied.)													
Minimum thickness of concrete	$h_{min} \geq$	[mm]	80		100		110	110	110	125	130	140	160
Case 1 ($N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$)													
Characteristic resistance in uncracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	7,5	-	16		16	20	25	25	30	30	30
Spacing (edge distance)	$s_{cr,sp}\ (= 2\,c_{cr,sp})$	[mm]	3 h_{ef}	-	3 h_{ef}		3 h_{ef}						
Case 2													
Spacing (edge distance)	$s_{cr,sp}\ (= 2\,c_{cr,sp})$	[mm]	6 h_{ef}	7 h_{ef}	6 h_{ef}	7 h_{ef}	7 h_{ef}	7 h_{ef}	6 h_{ef}	7 h_{ef}	6 h_{ef}	6 h_{ef}	6 h_{ef}
Increasing factor for $N_{Rk,p}$ and $N^0_{Rk,sp}$	ψ_C	[-]	$\left(\dfrac{f_{ck,cube}}{25}\right)^{0,5}$										
Concrete cone failure													
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	50	60	75	75	70	80	95	100	110	125
Factor acc. to CEN/TS 1992-4	k_{ucr}	[-]	10,1										

[1] Pull-out failure is not decisive
[2] Maximum long term temperature / Maximum short term temperature

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Injection System VMZ

Performance
Characteristic values for **tension loads, VMZ-A M8 – M12**, **uncracked concrete**, static and quasi-static action

Annex C2

Table C4: Characteristic values for **tension loads, VMZ-A M16 – M24, uncracked concrete**, static and quasi-static action

Anchor size VMZ-A			90 M16	105 M16	125 M16	145 M16	160 M16	115 M20	170 M20 (LG)	190 M20 (LG)	170 M24 (LG)	200 M24 (LG)	225 M24 (LG)
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0										
Steel failure													
Characteristic tension resistance $N_{Rk,s}$	Steel, zinc plated	[kN]	88	95	111	111	97	96	188	188	222	222	222
	A4, HCR	[kN]	88	95	111	111	97	114	165	165	194	194	194
Partial safety factor	γ_{Ms}	[-]			1,5			1,68	1,5			1,5	
Pull-out													
Characteristic resistance $N_{Rk,p}$ in uncracked concrete C20/25	50°C / 80°C [2]	[kN]		1)		75	90		1)			1)	
	72°C / 120°C [2]	[kN]	25	35	50	50	53	40	75	75	95	95	95
Splitting													
Splitting for **standard thickness of concrete** (The higher resistance of Case 1 and Case 2 may be applied.)													
Standard thickness of concrete	$h_{std} \geq 2\,h_{ef}$	[mm]	180	200	250	290	320	230	340	380	340	400	450
Case 1 ($N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$)													
Characteristic resistance in uncracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	40	50	50	60	80		1)	115		1)	140
Spacing (edge distance)	$s_{cr,sp} (= 2\,c_{cr,sp})$	[mm]	$3\,h_{ef}$										
Case 2													
Spacing (edge distance)	$s_{cr,sp} (= 2\,c_{cr,sp})$	[mm]	$4\,h_{ef}$	$4\,h_{ef}$	$4\,h_{ef}$	$4\,h_{ef}$	$4\,h_{ef}$	$3\,h_{ef}$	$3\,h_{ef}$	$4\,h_{ef}$	$3\,h_{ef}$	$3\,h_{ef}$	$3,6\,h_{ef}$
Splitting for **minimum thickness of concrete** (The higher resistance of Case 1 and Case 2 may be applied.)													
Minimum thickness of concrete	$h_{min} \geq$	[mm]	130	150	160	180	200	160	220	240	220	260	290
Case 1 ($N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$)													
Characteristic resistance in uncracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	35	50	40	50	71	-	75	75	1)	115	115
Spacing (edge distance)	$s_{cr,sp} (= 2\,c_{cr,sp})$	[mm]	$3\,h_{ef}$										
Case 2													
Spacing (edge distance)	$s_{cr,sp} (= 2\,c_{cr,sp})$	[mm]	$5\,h_{ef}$	$5\,h_{ef}$	$6\,h_{ef}$	$5\,h_{ef}$	$5\,h_{ef}$	$5\,h_{ef}$	$5,2\,h_{ef}$	$4,4\,h_{ef}$	$5,2\,h_{ef}$	$4,4\,h_{ef}$	$4,4\,h_{ef}$
Increasing factor for $N_{Rk,p}$ and $N^0_{Rk,sp}$	ψ_C	[-]	$\left(\dfrac{f_{ck,cube}}{25}\right)^{0,5}$										
Concrete cone failure													
Effective anchorage depth	$h_{ef} \geq$	[mm]	90	105	125	145	160	115	170	190	170	200	225
Factor acc. to CEN/TS 1992-4	k_{ucr}	[-]	10,1										

[1] Pull-out failure is not decisive
[2] Maximum long term temperature / Maximum short term temperature

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Injection System VMZ

Performance
Characteristic values for **tension loads, VMZ-A M16 – M24, uncracked concrete**, static and quasi-static action

Annex C3

Table C5: Characteristic values for **shear load**, VMZ-A M8 – M12, cracked and uncracked concrete, static and quasi-static action

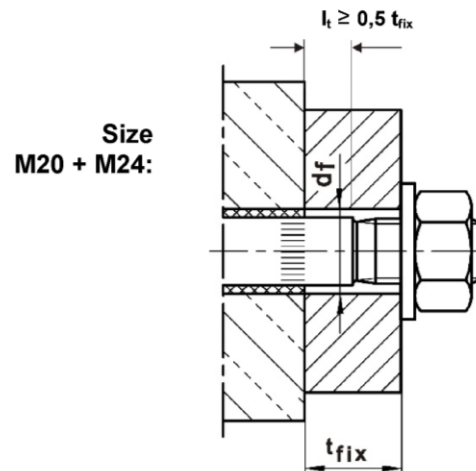| Anchor size VMZ-A			40 M8	50 M8	60 M10	75 M10	75 M12	70 M12	80 M12	95 M12	100 M12	110 M12	125 M12
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0										
Steel failure without lever arm													
Characteristic shear resistance $V_{Rk,s}$	Steel, zinc plated	[kN]	14		21		34						
	A4, HCR	[kN]	15		23		34						
Partial safety factor	γ_{Ms}	[-]	1,25										
Factor for ductility	k_2	[-]	1,0										
Steel failure with lever arm													
Characteristic bending moments $M^0_{Rk,s}$	Steel, zinc plated	[Nm]	30		60		105						
	A4, HCR	[Nm]	30		60		105						
Partial safety factor	γ_{Ms}	[-]	1,25										
Concrete pry-out failure													
Factor k acc. ETAG 001, Annex C or k_3 acc. CEN/TS 1992-4	$k_{(3)}$	[-]	2										
Concrete edge failure													
Effective length of anchor in shear load	l_f	[mm]	40	50	60	75	75	70	80	95	100	110	125
Diameter of anchor	d_{nom}	[mm]	10		12		12		14				

Injection System VMZ

Performance
Characteristic values for **shear load**, VMZ-A M8 – M12, cracked and uncracked concrete, static and quasi-static action

Annex C4

Table C6: Characteristic values for shear load, VMZ-A M16 – M24, cracked and uncracked concrete, static and quasi-static action

Anchor size VMZ-A			90 M16	105 M16	125 M16	145 M16	160 M16	115 M20	170 M20 (LG)	190 M20 (LG)	170 M24 (LG)	200 M24 (LG)	225 M24 (LG)
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]						1,0					
Steel failure without lever arm													
Characteristic shear resistance $V_{Rk,s}$	Steel, zinc plated	[kN]			63			70	149 [1] (98)		178 [1] (141)		
	A4, HCR	[kN]			63			86	131 [1] (86)		156 [1] (123)		
Partial safety factor	γ_{Ms}	[-]			1,25			1,4	1,25		1,25		
Factor for ductility	k_2	[-]						1,0					
Steel failure with lever arm													
Characteristic bending moments $M^0_{Rk,s}$	Steel, zinc plated	[Nm]			266			392	519		896		
	A4, HCR	[Nm]			266				454		784		
Partial safety factor	γ_{Ms}	[-]			1,25			1,4	1,25		1,25		
Concrete pry-out failure													
Factor k acc. ETAG 001, Annex C or k_3 acc. CEN/TS 1992-4	$k_{(3)}$	[-]						2					
Concrete edge failure													
Effective length of anchor in shear load	l_f	[mm]	90	105	125	145	160	115	170	190	170	200	225
Diameter of anchor	d_{nom}	[mm]			18			22	24			26	

[1] This value may only be applied if $l_t \geq 0,5\ t_{fix}$

Size M20 + M24:

$l_t \geq 0,5\ t_{fix}$

d_f

t_{fix}

Injection System VMZ

Performance
Characteristic values for **shear load, VMZ-A M16 – M24,**
cracked and uncracked concrete, static and quasi-static action

Annex C5

Table C7: Characteristic resistances for **seismic loading** VMZ-A M10 – M12 performance category **C1** and **C2**

Anchor size VMZ-A				60 M10	75 M10	75 M12	70 M12	80 M12	95 M12	100 M12	110 M12	125 M12
Tension loads												
Installation safety factor	$\gamma_2=\gamma_{inst}$		[-]	1,0								
Steel failure, steel zinc plated												
Characteristic resistance C1	$N_{Rk,s,seis,C1}$		[kN]	25		35	49	54		57		
Characteristic resistance C2	$N_{Rk,s,seis,C2}$		[kN]	25		35	49	54		57		
Steel failure, stainless steel A4, HCR												
Characteristic resistance C1	$N_{Rk,s,seis,C1}$		[kN]	25		35	49	54		57		
Characteristic resistance C2	$N_{Rk,s,seis,C2}$		[kN]	25		35	49	54		57		
Partial safety factor	$\gamma_{Ms,seis}$		[-]	1,5								
Pull-out												
Characteristic resistance C1	$N_{Rk,p,seis,C1}$	50°C / 80°C [1]	[kN]	14,5		14,5		30,6		36,0	41,5	42,8
		72°C / 120°C [1]	[kN]	10,9		10,9		20,0		30,0		
Characteristic resistance C2	$N_{Rk,p,seis,C2}$	50°C / 80°C [1]	[kN]	7,4		7,4		8,7		17,6		
		72°C / 120°C [1]	[kN]	5,1		5,1		6,5		12,3		

Shear loads												
Steel failure without lever arm, steel zinc plated												
Characteristic resistance C1	$V_{Rk,s,seis,C1}$		[kN]	11,8		27,2						
Characteristic resistance C2	$V_{Rk,s,seis,C2}$		[kN]	12,6		27,2						
Partial safety factor	$\gamma_{Ms,seis}$		[-]	1,25								
Steel failure without lever arm, stainless steel A4, HCR												
Characteristic resistance C1	$V_{Rk,s,seis,C1}$		[kN]	12,9		27,2						
Characteristic resistance C2	$V_{Rk,s,seis,C2}$		[kN]	13,8		27,2						
Partial safety factor	$\gamma_{Ms,seis}$		[-]	1,25								
Steel failure with lever arm												
Characteristic bending moment C1	$M^0_{Rk,s,seis,C1}$		[Nm]	no performance determined								
Characteristic bending moment C2	$M^0_{Rk,s,seis,C2}$		[Nm]	no performance determined								

[1] Maximum long term temperature / Maximum short term temperature

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Injection System VMZ

Performance
Characteristic resistances for **seismic loading**, VMZ-A M10 – M12, performance category **C1** and **C2**

Annex C6

Table C8: Characteristic resistances for **seismic loading** VMZ-A M16 – M24 performance category **C1** and **C2**

Anchor size VMZ-A			90 M16	105 M16	125 M16	145 M16	160 M16	115 M20	170 M20 (LG)	190 M20 (LG)	170 M24 (LG)	200 M24 (LG)	225 M24 (LG)
Tension loads													
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0										
Steel failure, steel zinc plated													
Characteristic resistance **C1** $N_{Rk,s,seis,C1}$		[kN]	88	95	111		97	96	188		222		
Characteristic resistance **C2** $N_{Rk,s,seis,C2}$		[kN]	88	95	111		97	96	188		222		
Steel failure, stainless steel A4, HCR													
Characteristic resistance **C1** $N_{Rk,s,seis,C1}$		[kN]	88	95	111		97	114	165		194		
Characteristic resistance **C2** $N_{Rk,s,seis,C2}$		[kN]	88	95	111		97	114	165		194		
Partial safety factor	$\gamma_{Ms,seis}$	[-]	1,5					1,68	1,5		1,5		
Pull-out													
Characteristic resistance **C1** $N_{Rk,p,seis,C1}$	50°C / 80°C [1]	[kN]	30,7	38,7	43,7			44,4	88,2		90,7		
	72°C / 120°C [1]	[kN]	25,0	30,0	38,5			29,4	55,8		59,3		
Characteristic resistance **C2** $N_{Rk,p,seis,C2}$	50°C / 80°C [1]	[kN]	16,3	22,1	26,1			30,9	59,7		59,7		
	72°C / 120°C [1]	[kN]	10,5	14,4	19,5			16,2	44,4		44,4		
Shear loads													
Steel failure without lever arm, steel zinc plated													
Characteristic resistance **C1** $V_{Rk,s,seis,C1}$		[kN]	39,1					39,1	82,3		107		
Characteristic resistance **C2** $V_{Rk,s,seis,C2}$		[kN]	50,4					51,0	108,8 [1] (71,5)		154,9 [1] (122,7)		
Partial safety factor	$\gamma_{Ms,seis}$	[-]	1,25					1,4	1,25		1,25		
Steel failure without lever arm, stainless steel A4, HCR													
Characteristic resistance **C1** $V_{Rk,s,seis,C1}$		[kN]	39,1					39,1	72,2		93		
Characteristic resistance **C2** $V_{Rk,s,seis,C2}$		[kN]	50,4					62,6	95,6 [1] (62,8)		135,7 [1] (107)		
Partial safety factor	$\gamma_{Ms,seis}$	[-]	1,25					1,4	1,25		1,25		
Steel failure with lever arm													
Characteristic bending moment **C1** $M^0_{Rk,s,seis,C1}$		[Nm]	no performance determined										
Characteristic bending moment **C2** $M^0_{Rk,s,seis,C2}$		[Nm]	no performance determined										

[1] This value may only be applied if $l_t \geq 0,5\ t_{fix,}$ (see Annex C5)

Injection System VMZ

Performance
Characteristic resistances for **seismic loading**, VMZ-A M16 – M24,
performance category **C1** and **C2**

Annex C7

Table C9: Displacements under tension loads, VMZ-A M8 – M12

Anchor size VMZ-A			40 M8	50 M8	60 M10	75 M10	75 M12	70 M12	80 M12	95 M12	100 M12	110 M12	125 M12
Tension load in cracked concrete	N	[kN]	4,3	6,1	8,0	11,1	11,1	10,0	12,3	15,9	17,1	19,8	24,0
Displacement	δ_{N0}	[mm]	0,5	0,5	0,5	0,6	0,6	0,6	0,6	0,6	0,6	0,7	0,7
	$\delta_{N\infty}$	[mm]	1,3										
Tension load in uncracked concrete	N	[kN]	4,3	8,5	11,1	15,6	15,6	14,1	17,2	19,0	24,0	23,8	23,8
Displacement	δ_{N0}	[mm]	0,2	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,6	0,6
	$\delta_{N\infty}$	[mm]	1,3										
Displacements under seismic tension loads **C2**													
Displacements for DLS	$\delta_{N,seis,C2(DLS)}$	[mm]	-	-	1,0		1,0		1,3		1,1		
Displacements for ULS	$\delta_{N,seis,C2(ULS)}$	[mm]	-	-	3,0		3,0		3,9		3,0		

Table C10: Displacements under tension loads, VMZ-A M16 – M24

Anchor size VMZ-A			90 M16	105 M16	125 M16	145 M16	160 M16	115 M20	170 M20 (LG)	190 M20 (LG)	170 M24 (LG)	200 M24 (LG)	225 M24 (LG)
Tension load in cracked concrete	N	[kN]	14,6	18,4	24,0	30,0	34,7	21,1	38,0	44,9	38,0	48,5	57,9
Displacement	δ_{N0}	[mm]	0,7	0,7	0,7	0,8	1,2	0,7	0,8	0,8	0,8	0,9	0,9
	$\delta_{N\infty}$	[mm]	1,3				1,6	1,1	1,3		1,3		
Tension load in uncracked concrete	N	[kN]	20,5	25,9	33,0	35,7	48,1	29,6	53,3	63,0	53,3	67,9	81,1
Displacement	δ_{N0}	[mm]	0,6	0,6	0,6	0,6	0,8	0,5	0,6	0,6	0,6	0,6	0,6
	$\delta_{N\infty}$	[mm]	1,3				1,6	1,1	1,3		1,3		
Displacements under seismic tension loads **C2**													
Displacements for DLS	$\delta_{N,seis,C2(DLS)}$	[mm]	1,6		1,5			1,7	1,9		1,9		
Displacements for ULS	$\delta_{N,seis,C2(ULS)}$	[mm]	3,7		4,4			4,0	4,5		4,5		

Table C11: Displacements under shear loads VMZ-A M8 – M12

Anchor size VMZ-A			40 M8	50 M8	60 M10	75 M10	75 M12	70 M12	80 M12	95 M12	100 M12	110 M12	125 M12
Shear load	V	[kN]	8,3		13,3		19,3						
Displacements	δ_{V0}	[mm]	2,4	2,5	2,9		3,3						
	$\delta_{V\infty}$	[mm]	3,6	3,8	4,4		5,0						
Displacements under seismic shear loads C2													
Displacements for DLS	$\delta_{V,seis,C2(DLS)}$	[mm]	-	-	2,1		2,5						
Displacements for ULS	$\delta_{V,seis,C2(ULS)}$	[mm]	-	-	3,7		5,1						

Table C12: Displacements under shear loads VMZ-A M16 – M24

Anchor size VMZ-A			90 M16	105 M16	125 M16	145 M16	160 M16	115 M20	170 M20 (LG)	190 M20 (LG)	170 M24 (LG)	200 M24 (LG)	225 M24 (LG)
Shear load	V	[kN]	36					44	75 (49)		89 (71)		
Displacements	δ_{V0}	[mm]	3,8					3,0	4,3 (3,0)		4,6 (3,5)		
	$\delta_{V\infty}$	[mm]	5,7					4,5	6,5 (4,5)		6,9 (5,3)		
Displacements under seismic shear loads C2													
Displacements for DLS	$\delta_{V,seis,C2(DLS)}$	[mm]	2,9						3,5		3,7		
Displacements for ULS	$\delta_{V,seis,C2(ULS)}$	[mm]	6,8						9,3		9,3		

Injection System VMZ

Performance
Displacements under shear loads, **VMZ-A**

Annex C9

Table C13:   Characteristic values for tension load, VMZ-IG , cracked concrete

Anchor size VMZ-IG			40 M6	50 M6	60 M8	75 M8	70 M10	80 M10	90 M12	105 M12	125 M12	115 M16	170 M16	170 M20
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0											
Steel failure														
Characteristic tension resistance $N_{Rk,s}$	Steel, zinc plated	[kN]	15	16	19	29	35		67			52	125	108
	A4, HCR	[kN]	11		19	21	33		47			65	88	94
Partial safety factor	γ_{Ms}	[-]	1,5											
Pull-out														
Characteristic resistance $N_{Rk,p}$ in cracked concrete C20/25	50°C / 80°C [2]	[kN]	1)											
	72°C / 120°C [2]	[kN]	5	7,5	12		16	20	20	30	50	30	60	75
Increasing factor	ψ_c	[-]	$\left(\dfrac{f_{ck,cube}}{25}\right)^{0,5}$											
Concrete cone failure														
Effective anchorage depth	h_{ef}	[mm]	40	50	60	75	70	80	90	105	125	115	170	170
Factor according to CEN/TS 1992-4	k_{cr}	[-]	7,2											

[1] Pull-out failure is not decisive
[2] Maximum long term temperature / Maximum short term temperature

Injection System VMZ

Performance
Characteristic values for **tension load, VMZ-IG, cracked concrete**

Annex C10

Table C14: Characteristic values for **tension load**, **VMZ-IG**, uncracked concrete

Anchor size VMZ-IG				40 M6	50 M6	60 M8	75 M8	70 M10	80 M10	90 M12	105 M12	125 M12	115 M16	170 M16	170 M20
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]		1,0											
Steel failure															
Characteristic tension resistance $N_{Rk,s}$	Steel, zinc plated	[kN]		15	16	19	29	35	35	67	67	67	52	125	108
	A4, HCR	[kN]		11	11	19	21	33	33	47	47	47	65	88	94
Partial safety factor	γ_{Ms}	[-]		1,5											
Pull-out															
Characteristic resistance $N_{Rk,p}$ in uncracked concrete C20/25	50°C / 80°C [2]	[kN]		9	1)					1)					
	72°C / 120°C [2]	[kN]		6	9	16	16	16	25	25	35	50	40	75	95
Splitting															
Splitting for standard thickness of concrete (The higher resistance of Case 1 and Case 2 may be applied.)															
Standard thickness of concrete	$h_{std} \geq 2h_{ef}$	[mm]		100	100	120	150	140	160	180	200	250	230	340	340
Case 1 ($N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$)															
Characteristic resistance in concrete C20/25	$N^0_{Rk,sp}$	[kN]		7,5	9	16	20	20	1)	40	50	50	1)		1)
Spacing (edge distance)	$s_{cr,sp}$ (= $2\ c_{cr,sp}$)	[mm]		$3\ h_{ef}$											
Case 2															
Spacing (edge distance)	$s_{cr,sp}$ (= $2\ c_{cr,sp}$)	[mm]		$6h_{ef}$	$6h_{ef}$	$5h_{ef}$	$7h_{ef}$	$5h_{ef}$	$3h_{ef}$	$4h_{ef}$	$4h_{ef}$	$4h_{ef}$	$3h_{ef}$	$3h_{ef}$	$3h_{ef}$
Splitting for minimum thickness of concrete (The higher resistance of Case 1 and Case 2 may be applied.)															
Minimum thickness of concrete	$h_{min} \geq$	[mm]		80	80	100	110	110	110	130	150	160	160	220	220
Case 1 ($N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$)															
Characteristic resistance in concrete C20/25	$N^0_{Rk,sp}$	[kN]		7,5	-	16	16	20	25	35	50	40	-	75	1)
Spacing (edge distance)	$s_{cr,sp}$ (= $2\ c_{cr,sp}$)	[mm]		$3\ h_{ef}$											
Case 2															
Spacing (edge distance)	$s_{cr,sp}$ (= $2\ c_{cr,sp}$)	[mm]		$6\ h_{ef}$	$7\ h_{ef}$	$6\ h_{ef}$	$7\ h_{ef}$	$7\ h_{ef}$	$6\ h_{ef}$	$5\ h_{ef}$	$5\ h_{ef}$	$6\ h_{ef}$	$5\ h_{ef}$	$5,2h_{ef}$	$5,2h_{ef}$
Increasing factor for $N_{Rk,p}$ and $N^0_{Rk,sp}$	ψ_c	[-]		$\left(\dfrac{f_{ck,cube}}{25}\right)^{0,5}$											
Concrete cone failure															
Effective anchorage depth	h_{ef}	[mm]		40	50	60	75	70	80	90	105	125	115	170	170
Factor according to CEN/TS 1992-4	k_{ucr}	[-]		10,1											

1) Pull-out failure is not decisive
2) Maximum long term temperature / Maximum short term temperature

Injection System VMZ

Performance
Characteristic values for tension loads, **VMZ-IG**, uncracked concrete

Annex C11

Table C15: Characteristic values for **shear load, VMZ-IG, cracked and uncracked concrete**

Anchor size VMZ-IG			40 M6	50 M6	60 M8	75 M8	70 M10	80 M10	90 M12	105 M12	125 M12	115 M16	170 M16	170 M20
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0											
Steel failure without lever arm														
Characteristic shear resistance $V_{Rk,s}$	Steel, zinc plated	[kN]	8,0	9,5	15	18		34				26	63	54
	A4, HCR	[kN]	5,5	9,5	10	16		24				32	44	47
Partial safety factor	γ_{Ms}	[-]	1,25											
Factor for ductility	k_2	[-]	1,0											
Steel failure with lever arm														
Characteristic bending moments $M^0_{Rk,s}$	Steel, zinc plated	[kN]	12		30		60		105			212	266	519
	A4, HCR	[kN]	8,5		21		42		74			187	187	365
Partial safety factor	γ_{Ms}	[-]	1,25											
Concrete pry-out failure														
Factor k acc. ETAG 001, Annex C or k_3 acc. CEN/TS 1992-4	$k_{(3)}$	[-]	2											
Concrete edge failure														
Effective length of anchor in shear load	l_f	[mm]	40	50	60	75	70	80	90	105	125	115	170	170
Diameter of anchor	d_{nom}	[mm]	10		12		14			18		22	24	26

Table C16: Displacements under **tension loads, VMZ-IG**

Anchor size VMZ-IG			40 M6	50 M6	60 M8	75 M8	70 M10	80 M10	90 M12	105 M12	125 M12	115 M16	170 M16	170 M20
Tension load in **cracked** concrete	N	[kN]	4,3	6,1	8,0	11,1	10,0	12,3	14,6	18,4	24,0	21,1	38,0	38,0
Displacement	δ_{N0}	[mm]	0,5		0,5	0,6	0,6		0,7			0,7	0,8	0,8
	$\delta_{N\infty}$	[mm]	1,3									1,1	1,3	1,3
Tension load in **uncracked** concrete	N	[kN]	4,3	8,5	11,1	15,6	14,1	17,2	20,5	25,9	33,0	29,6	53,3	53,3
Displacement	δ_{N0}	[mm]	0,2	0,4	0,4		0,4		0,6			0,5	0,6	0,6
	$\delta_{N\infty}$	[mm]	1,3									1,1	1,3	1,3

Table C17: Displacements under **shear loads, VMZ-IG**

Anchor size VMZ-IG			40 M6	50 M6	60 M8	75 M8	70 M10	80 M10	90 M12	105 M12	125 M12	115 M16	170 M16	170 M20
Shear load **Steel, zinc plated**	V	[kN]	4,6		5,4	8,4	10,1		19,3			14,8	35,8	30,7
Displacement	δ_{V0}	[mm]	0,4		0,5	0,4	0,5		1,2			0,8	1,9	1,2
	$\delta_{V\infty}$	[mm]	0,7		0,8	0,7	0,8		1,9			1,2	2,8	1,9
Shear load **Stainless steel A4 / HCR**	V	[kN]	3,2		5,4	5,9	9,3		13,5			18,5	25,2	26,9
Displacement	δ_{V0}	[mm]	0,3		0,5	0,3	0,5		0,9			1,0	1,4	1,1
	$\delta_{V\infty}$	[mm]	0,4		0,7	0,5	0,7		1,4			1,5	2,1	1,6

Injection System VMZ

Performance
Characteristic values for **shear load, VMZ-IG, cracked and uncracked concrete, Displacements**

Annex C12