

DECLARAȚIA DE PERFORMANȚĂ
DoP Nr. MKT-312 - ro

- Cod unic de identificare al produsului-tip: **sistem de injecție MKT VMZ & VMZ-IG**
- Tipul, lotul sau numărul de serie sau orice alt element care permite identificarea produsului pentru construcții astfel cum este solicitat la articolul 11 alineatul (4):

ETA-04/0092, Annex A3, A5
Număr lot: a se vedea ambalajul

- Utilizarea sau utilizările preconizate ale produsului pentru construcții, în conformitate cu specificația tehnică armonizată aplicabilă, astfel cum este prevăzut de fabricant:

Produs-tip	ancoră chimică cu moment de răsucire controlat
Pentru utilizarea în	beton fisurat și nefisurat C20/25 - C50/60 (EN 206)
Opțiune	1
Solicitare	beton fisurat și nefisurat, seismic, categorie C1+C2 (dimensiuni VMZ: M10, M12, M16, M20, M24)
Material	<p><u>oțel foc galvanizat sau diffusion galvanizat:</u> numai în incinte uscate dimensiuni incluse: VMZ: M8, M10, M12, M16, M20, M24</p> <p><u>oțel diffusion galvanizat:</u> numai în incinte uscate dimensiuni incluse: VMZ-IG: M6, M8, M10, M12, M16, M20</p> <p><u>oțel galvanizat:</u> numai în incinte uscate dimensiuni incluse: VMZ: M8, M10, M12, M16, M20, M24 VMZ-IG: M6, M8, M10, M12, M16, M20</p> <p><u>oțel inoxidabil (marcaj A4):</u> în incinte și în spații exterioare fără condiții deosebit de agresive dimensiuni incluse: VMZ: M8, M10, M12, M16, M20, M24 VMZ-IG: M6, M8, M10, M12, M16, M20</p> <p><u>oțel foarte rezistent la coroziune (marcaj HCR):</u> în incinte și în spații exterioare cu condiții deosebit de agresive dimensiuni incluse: VMZ: M8, M10, M12, M16, M20, M24 VMZ-IG: M6, M8, M10, M12, M16, M20</p>
Interval de temperatură (dacă este cazul)	Intervalul de temperatură I: -40 °C - 80 °C Intervalul de temperatură II: -40 °C - 120 °C

- Numele, denumirea socială sau marca înregistrată și adresa de contact a fabricantului, astfel cum se solicită în temeiul articolului 11 alineatul (5):

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

- După caz, numele și adresa de contact a reprezentantului autorizat al cărui mandat acoperă atribuțiile specificate la articolul 12 alineatul (2): --

6. Sistemul sau sistemele de evaluare și verificare a constanței performanței produsului pentru construcții, astfel cum este prevăzut în anexa V: **sistemul 1**
7. În cazul declarației de performanță privind un produs pentru construcții acoperit de un standard armonizat: --
8. În cazul declarației de performanță pentru un produs pentru construcții pentru care s-a emis o evaluare tehnică europeană:

a emis: **Deutsches Institut für Bautechnik, Berlin**
ETA-04/0092
 pe baza **ETAG 001-5**

În conformitate cu sistemul 1, organismul de notificare a produsului 1343-CPR a efectuat:

- i) stabilirea produsului-tip pe baza unei încercări de tip (inclusiv a unei eșantionări), a unei calculări de tip, a tabelor cu valori sau a documentelor care conțin descrierea produsului;
- ii) inspecția inițială a fabricii și controlul din fabrică al producției;
- iii) supravegherea curentă și evaluarea controlului din fabrică al producției

și a emis: certificatul de constanță a performanței 1343-CPR-M 550-4/08.14

9. Performanța declarată:

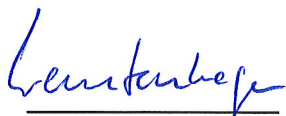
Caracteristici esențiale	Metodă de evaluare	Performanță		Specificație tehnică armonizată
		VMZ-A	VMZ-IG	
Rezistența caracteristică la tracțiune	ETAG 001, Annex C CEN/TS 1992-4	Annex C1-C3	Annex C10, C11	ETAG 001
Rezistența caracteristică la forfecare	ETAG 001, Annex C CEN/TS 1992-4	Annex C4, C5	Annex C12	
Rezistența caracteristică la seisme C1+C2	TR 045	Annex C6, C7	--	
Dislocare în stare uzată	ETAG 001, Annex C CEN/TS 1992-4	Annex C8, C9	Annex C12	

Atunci când s-a utilizat documentația tehnică specifică în temeiul articolului 37 sau al articolului 38, cerințele pe care le respectă produsul: --

10. Performanța produsului identificat la punctele 1 și 2 este în conformitate cu performanța declarată de la punctul 9.

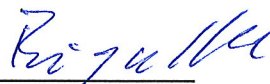
Această declarație de performanță este emisă pe răspunderea exclusivă a fabricantului identificat la punctul 4.

Semnată pentru și în numele fabricantului de către:



Stefan Weustenhagen
 (Administrator)
Weilerbach, 13.04.2017

i.V.



Dipl.-Ing. Detlef Bigalke
 (Șef Dezvoltare Produse)



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	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$										
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	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$										
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	Annex C1
Performance Characteristic values for tension loads, VMZ-A in cracked concrete, static and quasi-static action	

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 ($N_{Rk,c}^0$ has to be replaced by $N_{Rk,sp}^0$)													
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,sp}^0$	[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 ($N_{Rk,c}^0$ has to be replaced by $N_{Rk,sp}^0$)													
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,sp}^0$	[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}			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 $N_{Rk,sp}^0$	ψ_C	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$										
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

Injection System VMZ	Annex C2
Performance Characteristic values for tension loads, VMZ-A M8 – M12, uncracked concrete , static and quasi-static action	

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 ($N_{Rk,c}^0$ has to be replaced by $N_{Rk,sp}^0$)													
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,sp}^0$ [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 ($N_{Rk,c}^0$ has to be replaced by $N_{Rk,sp}^0$)													
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,sp}^0$ [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 $N_{Rk,sp}^0$	ψ_C [-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$											
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

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

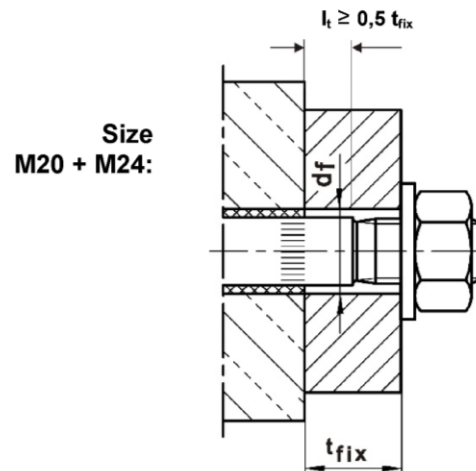
Characteristic values for **shear load, VMZ-A M8 – M12, cracked and uncracked concrete**, static and quasi-static action

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	Steel, zinc plated [kN]	63					70	149 ¹⁾ (98)		178 ¹⁾ (141)		
$V_{Rk,s}$	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	Steel, zinc plated [Nm]	266					392	519		896		
$M^0_{Rk,s}$	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 $l_t \geq 0,5 t_{fix}$



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

Injection System VMZ										Annex C6	
Performance Characteristic resistances for seismic loading, VMZ-A M10 – M12, performance category C1 and C2											

**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	Annex C7
Performance Characteristic resistances for seismic loading, VMZ-A M16 – M24, performance category C1 and C2	

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		

Injection System VMZ

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

Annex C8

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				

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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	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$												
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	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 uncracked concrete C20/25	50°C / 80°C ²⁾	[kN]	9	1 ¹⁾	1 ¹⁾									
	72°C / 120°C ²⁾	[kN]	6	9	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	120	150	140	160	180	200	250	230	340	340	
Case 1 ($N_{RK,c}$ has to be replaced by $N_{RK,sp}^0$)														
Characteristic resistance in concrete C20/25	$N_{RK,sp}^0$	[kN]	7,5	9	16	20	20	1 ¹⁾	40	50	50	1 ¹⁾	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]	6 h_{ef}	6 h_{ef}	5 h_{ef}	7 h_{ef}	5 h_{ef}	3 h_{ef}	4 h_{ef}	4 h_{ef}	4 h_{ef}	3 h_{ef}	3 h_{ef}	3 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]	80	100	110	110	130	150	160	160	220	220		
Case 1 ($N_{RK,c}$ has to be replaced by $N_{RK,sp}^0$)														
Characteristic resistance in concrete C20/25	$N_{RK,sp}^0$	[kN]	7,5	-	16	20	25	35	50	40	-	75	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]	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}	5,2 h_{ef}	5,2 h_{ef}
Increasing factor for $N_{RK,p}$ and $N_{RK,sp}^0$	ψ_c	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$											
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 $M_{Rk,s}^0$	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	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	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	Annex C12
Performance Characteristic values for shear load, VMZ-IG, cracked and uncracked concrete, Displacements	