

PRESTATIEVERKLARING
DoP Nr. MKT-312 - nl

1. Unieke identificatiecode van het producttype: **MKT Injektionssystem VMZ & VMZ-IG**
2. Type-, partij- of serienummer, dan wel een ander identificatiemiddel voor het bouwproduct, zoals voorgeschreven in artikel 11, lid 4:

ETA-04/0092, Bijlage A3 en A5
Chargennummer : zie verpakking

3. Beoogde gebruiken van het bouwproduct, overeenkomstig de toepasselijke geharmoniseerde technische specificatie, zoals door de fabrikant bepaald:

Producttype	verlijmd anker met gecontroleerd draaimoment
Voor toepassing in	gescheurd en ongescheurd beton C20/25 - C50/60 (EN 206)
Optie	1
Belasting	Statisch, quasi-statisch of seismisch, categorie C1+C2 (Maten VMZ: M10, M12, M16, M20, M24)
Materiaal	<p><u>thermisch verzinkt staal of diffusion verzinkt:</u> alleen in droge binnenruimtes inbegrepen maten: VMZ: M8, M10, M12, M16, M20, M24</p> <p><u>staal diffusion verzinkt:</u> alleen in droge binnenruimtes inbegrepen maten: VMZ-IG: M6, M8, M10, M12, M16, M20</p> <p><u>staal verzinkt:</u> alleen in droge binnenruimtes inbegrepen maten: VMZ: M8, M10, M12, M16, M20, M24 VMZ-IG: M6, M8, M10, M12, M16, M20</p> <p><u>roestvrij staal (markering A4):</u> voor binnen- en buitenbereiken zonder bijzonder agressieve omstandigheden inbegrepen maten: VMZ: M8, M10, M12, M16, M20, M24 VMZ-IG: M6, M8, M10, M12, M16, M20</p> <p><u>hoogcorrosiebestendig staal (markering HCR):</u> voor binnen- en buitenbereiken onder bijzonder agressieve omstandigheden inbegrepen maten: VMZ: M8, M10, M12, M16, M20, M24 VMZ-IG: M6, M8, M10, M12, M16, M20</p>
Temperatuurbereik (in voorkomende gevallen)	Bereik I: -40 °C - +80 °C Bereik II: -40 °C - +120 °C

4. Naam, geregistreerde handelsnaam of geregistreerd handelsmerk en contactadres van de fabrikant, zoals voorgeschreven in artikel 11, lid 5:

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

5. Indien van toepassing, naam en contactadres van de gemachtigde wiens mandaat de in artikel 12, lid 2, vermelde taken bestrijkt: --
6. Het systeem of de systemen voor de beoordeling en verificatie van de prestatiebestendigheid van het bouwproduct, vermeld in bijlage V: **System 1**
7. Indien de prestatieverklaring betrekking heeft op een bouwproduct dat onder een geharmoniseerde norm valt: --
8. Indien de prestatieverklaring betrekking heeft op een bouwproduct waarvoor een Europese technische beoordeling is afgegeven:

Deutsches Institut für Bautechnik, Berlin

heeft het volgende afgegeven:

ETA-04/0092

op basis van

ETAG 001-5

De aangemelde instantie voor productcertificering 1343-CPR heeft het volgende uitgevoerd volgens systeem 1:

- i) de bepaling van het producttype op grond van typeonderzoek (inclusief bemonstering), typeberekening, getabelleerde waarden of een beschrijvende documentatie van het product;
- ii) de initiële inspectie van de productie-installatie en van de productiecontrole in de fabriek;
- iii) permanente bewaking, beoordeling en evaluatie van de productiecontrole in de fabriek

en heeft het volgende afgegeven: het certificaat van prestatiebestendigheid 1343-CPR-M 550-4/08.14

9. Aangegeven prestatie:

Essentiële kenmerken	Beoordelingsmethode	Prestaties		Geharmoniseerde technische specificaties
		VMZ-A	VMZ-IG	
Karakteristieke trekweerstand	ETAG 001, bijlage C CEN/TS 1992-4	bijlage C1-C3	bijlage C10, C11	ETAG 001
Karakteristieke afschuifweerstand	ETAG 001, bijlage C CEN/TS 1992-4	bijlage C4, C5	bijlage C12	
Karakteristieke weerstand bij seismische inwerking	TR 045	bijlage C6, C7	--	
Verschuiving in gebruikstoestand	ETAG 001, bijlage C CEN/TS 1992-4	bijlage C8, C9	bijlage C12	

Indien overeenkomstig artikel 37 of 38 een specifieke technische documentatie is gebruikt, de eisen waaraan het product voldoet: --

10. De prestaties van het in de punten 1 en 2 omschreven product zijn conform de in punt 9 aangegeven prestaties. Deze prestatieverklaring wordt verstrekt onder de exclusieve verantwoordelijkheid van de in punt 4 vermelde fabrikant: Ondertekend voor en namens de fabrikant door:


Stefan Weustenhagen
 (Director)

Weilerbach, 13.04.2017

i.v.


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



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}							
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

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 ($N_{Rk,c}^0$ 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

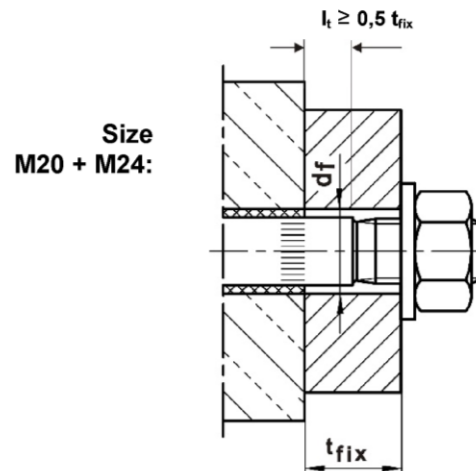
Characteristic values for **shear load, VMZ-A M8 – M12, cracked and uncracked concrete**, static and quasi-static action

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	$M_{Rk,s,seis,C1}^0$	[Nm]	no performance determined									
Characteristic bending moment C2	$M_{Rk,s,seis,C2}^0$	[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				

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	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$												
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)									
	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)	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]	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}	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	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)		
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
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

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

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

Annex C12