... eine starke Verbindung

DEKLARACJA WŁAŚCIWOŚCI UŻYTKOWYCH
DoP Nr. MKT-312 - pl

1. Niepowtarzalny kod identyfikacyjny typu wyrobu: **MKT Injektionssystem VMZ & VMZ-IG**

2. Numer typu, partii lub serii lub jakikolwiek inny element umożliwiający identyfikację wyrobu budowlanego, wymagany zgodnie z art. 11 ust. 4:

ETA-04/0092, załącznik A3, A5
Numer partii na etykiecie lub opakowaniu

3. Przewidziane przez producenta zamierzone zastosowanie lub zastosowania wyrobu budowlanego zgodnie z mającą zastosowanie zharmonizowaną specyfikacją techniczną:

typ ogólny	kotwa wklejana z kontrolowanym momentem dokręcania
do zastosowania w	beton zarysowany i niezarysowany C20/25 - C50/60 (EN 206)
opcja	1
obciążenie	statyczne lub quasi-statyczne, sejsmiczny, kategoria C1+C2 (o rozmiarach VMZ: M10, M12, M16, M20, M24)
materiał	<u>stal ocynkowana lub dyfuzja ocynkowane:</u> zastosowanie tylko w suchych warunkach o rozmiarach: VMZ: M8, M10, M12, M16, M20, M24 <u>stal dyfuzja ocynkowane:</u> zastosowanie tylko w suchych warunkach o rozmiarach: VMZ-IG: M6, M8, M10, M12, M16, M20 <u>stal ocynkowana galwanicznie:</u> zastosowanie tylko w suchych warunkach o rozmiarach: VMZ: M8, M10, M12, M16, M20, M24 VMZ-IG: M6, M8, M10, M12, M16, M20 <u>stal nierdzewna (oznaczenie A4):</u> do zastosowania wewnątrz i na zewnątrz budynków bez szczególnie agresywnych warunków o rozmiarach: VMZ: M8, M10, M12, M16, M20, M24 VMZ-IG: M6, M8, M10, M12, M16, M20 <u>stal o wysokiej odporności na korozję (oznaczenie HCR):</u> do zastosowania wewnątrz i na zewnątrz budyków, z narażeniem na szczególnie agresywne środowisko o rozmiarach: VMZ: M8, M10, M12, M16, M20, M24 VMZ-IG: M6, M8, M10, M12, M16, M20
zakres temperaturowy jeśli dotyczy	obszar I: -40 °C - +80 °C obszar II: -40 °C - +120 °C

4. Nazwa, zastrzeżona nazwa handlowa lub zastrzeżony znak towarowy oraz adres kontaktowy producenta, wymagany zgodnie z art. 11 ust. 5:

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

5. W stosownych przypadkach nazwa i adres kontaktowy upoważnionego przedstawiciela, którego pełnomocnictwo obejmuje zadania określone w art. 12 ust. 2: --

6. System lub systemy oceny i weryfikacji stałości właściwości użytkowych wyrobu budowlanego określone w załączniku V: **System 1**

7. W przypadku deklaracji właściwości użytkowych dotyczącej wyrobu budowlanego objętego normą zharmonizowaną:

   --

8. W przypadku deklaracji właściwości użytkowych dotyczącej wyrobu budowlanego, dla którego wydana została europejska ocena techniczna:

   Deutsches Institut für Bautechnik, Berlin

   wydał(-a/-o):

   ETA-04/0092

   na podstawie

   ETAG 001-5

   Notyfikowana jednostka certyfikująca wyrób 1343-CPR dokonał w systemie 1:

   i) ustalenia typu wyrobu na podstawie badań typu (w tym pobierania próbek), obliczeń typu, tabelarycznych wartości lub opisowej dokumentacji wyrobu;
   ii) wstępnej inspekcji zakładu produkcyjnego i zakładowej kontroli produkcji;
   iii) stałego nadzoru, oceny i ewaluacji zakładowej kontroli produkcji.

   i wydał: certyfikat stałości właściwości użytkowych 1343-CPR-M 550-4/08.14

9. Deklarowane właściwości użytkowe:

Zasadnicze charakterystyki	**Metoda projektowa**	**Właściwości użytkowe**		**Zharmonizowana specyfikacja techniczna**
		VMZ-A	**VMZ-IG**	
nośność charakterystyczna na wyrywanie	ETAG 001, załącznik C CEN/TS 1992-4	załącznik C1-C3	załącznik C10, C11	ETAG 001
nośność charakterystyczna na ścinanie	ETAG 001, załącznik C CEN/TS 1992-4	załącznik C4, C5	załącznik C12	
charakterystyczna odporności na działania sejsmiczne	TR 045	załącznik C6, C7	--	
przemieszczenie w stanie granicznym użytkowania	ETAG 001, załącznik C CEN/TS 1992-4	załącznik C8, C9	załącznik C12	

   W przypadku gdy na podstawie art. 37 lub 38 zastosowana została specjalna dokumentacja techniczna, wymagania, z którymi wyrób jest zgodny: --

10. Właściwości użytkowe wyrobu określone w pkt 1 i 2 są zgodne z właściwościami użytkowymi deklarowanymi w pkt 9.

    Niniejsza deklaracja właściwości użytkowych wydana zostaje na wyłączną odpowiedzialność producenta określonego w pkt 4.

    W imieniu producenta podpisał(-a):

Stefan Weustenhagen
(Menedżer)
Weilerbach, 13.04.2017

i.V.
Dipl.-Ing. Detlef Bigalke
(Kierownik Rozwoju Produktu)

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

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		
Characteristic tension resistance $N_{Rk,s}$ 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	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$										
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

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

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

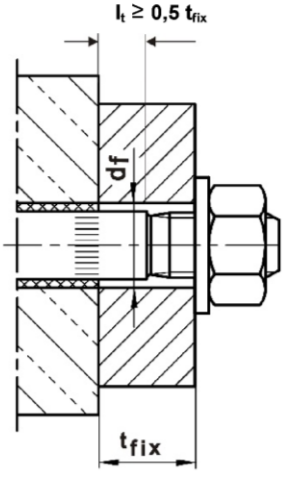
Anchor size VMZ-A			**40 M8**	**50 M8**	**60 M10**	**75 M10**	**75 M12**	**70 M12**	**80 M12**	**95 M12**	**100 M12**	**110 M12**	**125 M12**
Installation safety factor	$\gamma_2=\gamma_{inst}$	[-]	1,0										
Steel failure without lever arm													
Characteristic shear resistance $V_{Rk,s}$	Steel, 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					

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:



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

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		
	$N_{Rk,p,seis,C1}$ 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		
	$N_{Rk,p,seis,C2}$ 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)

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		

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

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 ($N^0_{Rk,c}$ 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		100	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		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	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$											
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

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