... eine starke Verbindung

PRESTANDADEKLARATION
DoP Nr. MKT-320 - sv

1. Produkttypens unika identifikationskod: **MKT Injektionssysystem VMU plus**

2. Typ-, parti- eller serienummer eller någon annan beteckning som möjliggör identifiering av byggprodukter i enlighet med artikel 11.4:

ETA-11/0415, Appendix 1 och 2
Partinummer: se förpackning

3. Byggproduktens avsedda användning eller användningar i enlighet med den tillämpliga, harmoniserade tekniska specifikationen, såsom förutsett av tillverkaren:

Typ av produkt	Ankarmassa
För användning i	sprucken och osprucken betong C20/25 - C50/60 (EN 206)
Option	1
Belastning	statiska eller kvasistatiska, jordbävning Kategori C1
Material	<u>varmförzinkad stål:</u> endast i torra utrymmen storlekar: osprucken betong: M8, M10, M12, M16, M20, M24, M27, M30 sprucken betong + C1: M12, M16, M20, M24, M27, M30 <u>Galvaniserat stål:</u> endast i torra utrymmen storlekar: osprucken betong: M8, M10, M12, M16, M20, M24, M27, M30 sprucken betong + C1: M12, M16, M20, M24, M27, M30 <u>Rostfritt stål (Prägling A4):</u> inomhus och utomhus förutom särskilt aggressiva förhållanden storlekar: osprucken betong: M8, M10, M12, M16, M20, M24, M27, M30 sprucken betong + C1: M12, M16, M20, M24, M27, M30 <u>Mycket korrosionsbeständigt stål (Prägling HCR):</u> inomhus och utomhus områden med särskilt aggressiva förhållanden storlekar: osprucken betong: M8, M10, M12, M16, M20, M24, M27, M30 sprucken betong + C1: M12, M16, M20, M24, M27, M30 <u>Armeringsstål (B500 B):</u> storlekar: osprucken betong: Ø8, Ø10, Ø12, Ø14, Ø16, Ø20, Ø25, Ø28, Ø32 sprucken betong + C1: Ø12, Ø14, Ø16, Ø20, Ø25, Ø28, Ø32
Temperaturområde (möjligen)	Temperaturområde I: -40 °C - +40 °C Temperaturområde II: -40 °C - +80 °C Temperaturområde III: -40 °C - +120 °C

4. Tillverkarens namn, registrerade företagsnamn eller registrerade varumärke samt kontaktadress enligt vad som krävs i artikel 11.5:

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

5. I tillämpliga fall namn och kontaktadress för tillverkarens representant vars mandat omfattar de uppgifter som anges i artikel 12.2: --

6. Systemet eller systemen för bedömning och fortlöpande kontroll av byggproduktens prestanda enligt bilaga V: **System 1**

7. För det fall att prestandadeklarationen avser en byggprodukt som omfattas av en harmoniserad standard: --

8. För det fall att prestandadeklarationen avser en byggprodukt för vilken en europeisk teknisk bedömning har utfärdats:

Deutsches Institut für Bautechnik, Berlin

har utfärdat

ETA-11/0415

på grundval av

ETAG 001-5

Det anmälda produktcertifieringsorganet 0756-CPD har utförts enligt System 1:

i) bestämning av produkttypen på grundval av typprovning (inkl. stickprov), typberäkning, tabellerade värden eller beskrivande dokumentation av produkten;
ii) inledande inspektion av tillverkningsanläggningen och tillverkningskontrollen i fabrik;
iii) fortlöpande övervakning, bedömning och utvärdering av tillverkningskontrollen i fabrik.

och har utfärdat: Intyg om överensstämmelse 0756-CPD-0445

9. Angiven prestanda:

Väsentliga egenskaper	**Design metod**	**Prestanda**		**Harmoniserad teknisk specifikation**
		Gängstång	**Armeringsstål**	
Karakteristisk motstånd mot dragbelastningar	TR 029	ETA-11/0415, Appendix 9, 10	ETA-11/0415, Appendix 12, 13	ETAG 001
	CEN/TS 1992-4	ETA-11/0415, Appendix 15,16	ETA-11/0415, Appendix 18, 19	
Karakteristisk resistens mot skjuvlaster	TR 029	ETA-11/0415, Appendix 11	ETA-11/0415, Appendix 14	
	CEN/TS 1992-4	ETA-11/0415, Appendix 17	ETA-11/0415, Appendix 20	
Karakteristiskt motstånd mot jordbävningar C1	TR 045	ETA-11/0415, Appendix 24		
Minsta avstånd och kantavstånd	TR 029	ETA-11/0415, Appendix 5		
	CEN/TS 1992-4			
Skift i bruk	TR 029	ETA-11/0415, Appendix 21	ETA-11/0415, Appendix 22	
	CEN/TS 1992-4			

När den specifika tekniska dokumentationen har använts enligt artikel 37 eller 38, de krav med vilka produkten överensstämmer: --

10. Prestandan för den produkt som anges i punkterna 1 och 2 överensstämmer med den prestanda som anges i punkt 9.

Denna prestandadeklaration utfärdas på eget ansvar av den tillverkare som anges under punkt 4.

Undertecknat för tillverkaren av:

Lore Weustenhagen
(Verkställande direktör)
Weilerbach, 30.06.2013

i.V.
Dipl.-Ing. Detlef Bigalke
(Produktutveckling direktör)

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Table 3: Installation parameters for threaded rod

Anchor size		M8	M10	M12	M16	M20	M24	M27	M30
Nominal drill hole diameter	d_0 [mm] =	10	12	14	18	24	28	32	35
Embedment depth and bore hole depth	$h_{ef,min}$ [mm] =	60	60	70	80	90	96	108	120
	$h_{ef,max}$ [mm] =	160	200	240	320	400	480	540	600
Diameter of clearance hole in the fixture	d_f [mm] ≤	9	12	14	18	22	26	30	33
Diameter of steel brush	d_b [mm] ≥	12	14	16	20	26	30	34	37
Installation torque	T_{inst} [Nm]	10	20	40	80	120	160	180	200
Thickness of fixture	$t_{fix,min}$ [mm] >	0							
	$t_{fix,max}$ [mm] <	1500							
Minimum thickness of member	h_{min} [mm]	h_{ef} + 30 mm ≥ 100 mm			h_{ef} + $2d_0$				
Minimum spacing	s_{min} [mm]	40	50	60	80	100	120	135	150
Minimum edge distance	c_{min} [mm]	40	50	60	80	100	120	135	150

Table 4: Installation parameters for reinforcing bar

Rebar size		∅ 8	∅ 10	∅ 12	∅ 14	∅ 16	∅ 20	∅ 25	∅ 28	∅ 32
Nominal drill hole diameter	d_0 [mm] =	12	14	16	18	20	24	32	35	40
Embedment depth and bore hole depth	$h_{ef,min}$ [mm] =	60	60	70	75	80	90	100	112	128
	$h_{ef,max}$ [mm] =	160	200	240	280	320	400	480	540	640
Diameter of steel brush	d_b [mm] ≥	14	16	18	20	22	26	34	37	41,5
Minimum thickness of member	h_{min} [mm]	h_{ef} + 30 mm ≥ 100 mm		h_{ef} + $2d_0$						
Minimum spacing	s_{min} [mm]	40	50	60	70	80	100	125	140	160
Minimum edge distance	c_{min} [mm]	40	50	60	70	80	100	125	140	160

MKT Injection System VMU plus for concrete

Installation parameters

Annex 5

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Table 7: Design according to TR 029, Characteristic values for tension loads in non-cracked concrete under static and quasi-static action

Anchor size threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure											
Characteristic tension resistance, Steel, property class 4.6		$N_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor		$\gamma_{Ms,N}$ [1)]	[-]	2,0							
Characteristic tension resistance, Steel, property class 5.8		$N_{Rk,s}$	[kN]	18	29	42	78	122	176	230	280
Characteristic tension resistance, Steel, property class 8.8		$N_{Rk,s}$	[kN]	29	46	67	125	196	282	368	449
Partial safety factor		$\gamma_{Ms,N}$ [1)]	[-]	1,50							
Characteristic tension resistance, Stainless steel A4 and HCR Property class 50 (>M24) and 70 (≤ M24)		$N_{Rk,s}$	[kN]	26	41	59	110	171	247	230	281
Partial safety factor		$\gamma_{Ms,N}$ [1)]	[-]	1,87						2,86	
Combined pull-out and concrete cone failure											
Characteristic bond resistance in non-cracked concrete C20/25											
Temperature range I [5)]: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	11	10	9
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	7,5	8,5	8,5	8,5	not admissible			
Temperature range II [5)]: 80°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,5	9	9	9	9	8,5	7,5	6,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	not admissible			
Temperature range III [5)]: 120°C/72°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	5,5	5,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	4,0	5,0	5,0	5,0	not admissible			
Increasing factors for concrete		ψ_c	C30/37	1,04							
			C40/50	1,08							
			C50/60	1,10							
Splitting failure											
Edge distance		$c_{cr,sp}$	[mm]	$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2{,}5 - \frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$							
Axial distance		$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$							
Partial safety factor (dry and wet concrete)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1)]	[-]	1,5 [2)]	1,8 [3)]						
Partial safety factor (flooded bore hole)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1)]	[-]	2,1 [4)]			not admissible				

[1)] In absence of other national regulations
[2)] The partial safety factor γ_2 = 1,0 is included.
[3)] The partial safety factor γ_2 = 1,2 is included.
[4)] The partial safety factor γ_2 = 1,4 is included.
[5)] Explanations see section 1.2

MKT Injection System VMU plus for concrete

Application with threaded rod, Design acc. to TR 029, Characteristic values for tension loads in non-cracked concrete under static and quasi-static action

Annex 9

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Table 8: Design according to TR 029, Characteristic values for tension loads in cracked concrete under static and quasi-static action

Anchor size threaded rod				**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure									
Characteristic tension resistance, Steel, property class 4.6	$N_{Rk,s}$	[kN]		34	63	98	141	184	224
Partial safety factor	$\gamma_{Ms,N}$ [1)]	[-]		2,0					
Characteristic tension resistance, Steel, property class 5.8	$N_{Rk,s}$	[kN]		42	78	122	176	230	280
Characteristic tension resistance, Steel, property class 8.8	$N_{Rk,s}$	[kN]		67	125	196	282	368	449
Partial safety factor	$\gamma_{Ms,N}$ [1)]	[-]		1,50					
Characteristic tension resistance, Stainless steel A4 and HCR Property class 50 (>M24) and 70 (≤ M24)	$N_{Rk,s}$	[kN]		59	110	171	247	230	281
Partial safety factor	$\gamma_{Ms,N}$ [1)]	[-]		1,87				2,86	
Combined pull-out and concrete cone failure									
Characteristic bond resistance in cracked concrete C20/25									
Temperature range I[4)]: 40°C/24°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	5,5	5,5	5,5	5,5	6,5	6,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	6,0	6,0	not admissible			
Temperature range II[4)]: 80°C/50°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	4,0	4,0	4,0	4,0	4,5	4,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	not admissible			
Temperature range III[4)]: 120°C/72°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	3,0	3,0	3,0	3,0	3,5	3,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	not admissible			
Increading factors for concrete	ψ_c	C30/37		1,04					
		C40/50		1,08					
		C50/60		1,10					
Spitting failure									
Edge distance	$c_{cr,sp}$	[mm]		$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2{,}5 - \frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$					
Axial distance	$s_{cr,sp}$	[mm]		$2\ c_{cr,sp}$					
Partial safety factor (dry and wet concrete)	$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1)]	[-]		1,8[2)]					
Partial safety factor (flooded bore hole)	$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1)]	[-]		2,1[3)]	not admissible				

[1)] In absence of other national regulations
[2)] The partial safety factor γ_2 = 1,2 is included.
[3)] The partial safety factor γ_2 = 1,4 is included.
[4)] Explanations see section 1.2

MKT Injection System VMU plus for concrete

Application with threaded rod, Design acc. to TR 029, Characteristic values for tension loads in cracked concrete under static and quasi-static action

Annex 10

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Table 9: Design according to TR 029, Characteristic values for shear loads in cracked and non-cracked concrete under static and quasi-static action

Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm										
Characteristic shear resistance, Steel, property class 4.6	$V_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,67							
Characteristic shear resistance, Steel, property class 5.8	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Characteristic shear resistance, Steel, property class 8.8	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,25							
Characteristic shear resistance, Stainless steel A4 and HCR Property class 50 (>M24) und 70 (≤ M24)	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	115	140
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,56						2,38	
Steel failure with lever arm										
Characteristic bending moment, Steel, property class 4.6	$M^0_{Rk,s}$	[Nm]	15	30	52	133	260	449	666	900
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,67							
Characteristic bending moment, Steel, property class 5.8	$M^0_{Rk,s}$	[Nm]	19	37	65	166	324	560	833	1123
Characteristic bending moment, Steel, property class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	896	1333	1797
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,25							
Characteristic bending moment, Stainless steel A4 and HCR property class 50 (>M24) and 70 (≤ M24)	$M^0_{Rk,s}$	[Nm]	26	52	92	232	454	784	832	1125
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,56						2,38	
Concrete pry-out failure										
Factor k in equation (5.7) of Technical Report TR 029 for the design of bonded anchors			2,0							
Partial safety factor	γ_{Mcp} [1]	[-]	1,50 [2]							
Concrete edge failure										
See section 5.2.3.4 of Technical Report TR 029 for the design of bonded anchors										
Partial safety factor	γ_{Mc} [1]	[-]	1,50 [2]							

[1] In absence of other national regulations
[2] The partial safety factor γ_2 = 1,0 is included.

MKT Injection System VMU plus for concrete

Application with threaded rod, Design acc. to TR 029, Characteristic values for shear loads in cracked and non-cracked concrete under static and quasi-static action

Annex 11

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Table 10: Design according to TR 029, Characteristic values for tension loads in non-cracked concrete under static and quasi-static action

Anchor size reinforcing bar				**∅ 8**	**∅ 10**	**∅ 12**	**∅ 14**	**∅16**	**∅ 20**	**∅ 25**	**∅ 28**	**∅ 32**
Steel failure												
Characteristic tension resistance, reinforcing bar according to Annex 4		$N_{Rk,s}$	[kN]	$A_s \times f_{uk}$ [6)]								
Partial safety factor		$\gamma_{Ms,N}$ [1)]	[-]	TR 029 Section 3.2.2.2, Eq. 3.3a [6)]								
Combined pull-out and concrete cone failure												
Characteristic bond resistance in uncracked concrete C20/25												
Temperature range I[5)]: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	12	11	10	8,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	7,5	8,5	8,5	8,5	8,5	not admissible			
Temperature range II[5)]: 80°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,5	9	9	9	9	9	8,0	7,0	6,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	not admissible			
Temperature range III[5)]: 120°C/72°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	6,0	5,0	4,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	4,0	5,0	5,0	5,0	5,0	not admissible			
Increasing factors for concrete		ψ_c	C30/37	1,04								
			C40/50	1,08								
			C50/60	1,10								
Splitting failure												
Edge distance		$c_{cr,sp}$	[mm]	$1,0 \cdot h_{ef} \le 2 \cdot h_{ef} \cdot \left(2,5 - \frac{h}{h_{ef}}\right) \le 2,4 \cdot h_{ef}$								
Axial distance		$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$								
Partial safety factor (dry adn wet concrete)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1)]	[-]	1,5[2)]	1,8[3)]							
Partial safety factor (flooded bore hole)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1)]	[-]	2,1[4)]				not admissible				

[1)] In absence of other national regulations
[2)] The partial safety factor γ_2 = 1,0 is included.
[3)] The partial safety factor γ_2 = 1,2 is included.
[4)] The partial safety factor γ_2 = 1,4 is included.
[5)] Ecplanations see section 1.2
[6)] f_{uk}, f_{yk}: see relevant Technical Specification for the reinforcing bar.

Regarding design of post-installed rebar as anchor see chapter 4.2.

MKT Injection System VMU plus for concrete

Application with reinforcing bar, Design acc. to TR 029, Characteristic values for tension loads in non-cracked concrete under static and quasi-static action

Annex 12

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Table 11: Design according to TR 029, Characteristic values for tension loads in cracked concrete under static and quasi-static action

Anchor size reinforcing bar				**Ø 12**	**Ø 14**	**Ø16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
Steel failure										
Characteristic tension resistance, reinforcing bar according to Annex 4		$N_{Rk,s}$	[kN]	$A_s \times f_{uk}$ [5]						
Partial safety factor		$\gamma_{Ms,N}$ [1]	[-]	TR 029 Section 3.2.2.2, Eq. 3.3a [5]						
Combined pull-out and concrete cone failure										
Characteristic bond resistance in cracked concrete C20/25										
Temperature range I[4]: 40°C/24°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	5,5	5,5	5,5	5,5	5,5	6,5	6,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	6,0	6,0	6,0	not admissible			
Temperature range II[4]: 80°C/50°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	4,0	4,0	4,0	4,0	4,0	4,5	4,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	4,5	not admissible			
Temperature range III[4]: 120°C/72°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	3,0	3,0	3,0	3,0	3,0	3,5	3,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	3,5	not admissible			
Increasing factors for concrete		ψ_c	C30/37	1,04						
			C40/50	1,08						
			C50/60	1,10						
Splitting failure										
Edge distance		$c_{cr,sp}$	[mm]	$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef} \cdot \left(2{,}5 - \frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$						
Axial distance		$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$						
Partial safety factor (dry and wet concrete)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1]	[-]	1,8[2]						
Partial safety factor (flooded bore hole)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1]	[-]	2,1[3]			not admissible			

[1] In absence of other national regulations
[2] The partial safety factor γ_2 = 1,2 is included.
[3] The partial safety factor γ_2 = 1,4 is included.
[4] Expananations see section 1.2
[5] f_{uk}, f_{yk}: see relevant Technical Specification for the reinforcing bar.

Regarding design of post-installed rebar as anchor see chapter 4.2.

MKT Injection System VMU plus for concrete

Application with reinforcing bar, Design acc. to TR 029, Characteristic values for tension loads in cracked concrete under static and quasi-static action

Annex 13

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Table 12: Design according to TR 029, Characteristic values for shear loads in cracked and non-cracked concrete under static and quasi-static action

Anchor size reinforcing bar			**Ø 8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
Steel failure without lever arm											
Characteristic shear resistance, reinforcing bar according to Annex 4	$V_{Rk,s}$	[kN]	$0,5 \times A_s \times f_{uk}$ [3]								
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	TR 029 Section 3.2.2.2, Eq. 3.3 b+c [3]								
Steel failure with lever arm											
Characteristic bending moment, reinforcing bar according to Annex 4	$M^0_{Rk,s}$	[Nm]	$1,2 \times W_{el} \times f_{uk}$ [3]								
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	TR 029 Section 3.2.2.2, Eq. 3.3 b+c [3]								
Concrete pry-out failure											
Factor k in equation (5.7) of Technical Report TR 029 for the design of bonded anchors			2,0								
Partial safety factor	γ_{Mcp} [1]	[-]	1,50 [2]								
Concrete edge failure											
See section 5.2.3.4 of Technical Report TR 029 for the design of bonded anchors											
Partial safety factor	γ_{Mc} [1]	[-]	1,50 [2]								

[1] In absence of other national regulations
[2] The partial safety factor $\gamma_2 = 1,0$ is included.
[3] f_{uk}, f_{yk}: see relevant Technical Specification for the reinforcing bar

Regarding design of post-installed rebar as anchor see chapter 4.2.

MKT Injection System VMU plus for concrete	**Annex 14**
Application with reinforcing bar, Design acc. to TR 029, Characteristic values for shear loads in cracked and non-cracked concrete under static and quasi-static action	

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Table 13: Design according to CEN/TS 1992-4, Characteristic values for tension loads in non-cracked conrete under static and quasi-static action

Anchor size threaded rod				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure											
Characteristic tension resistance, Steel, property class 4.6		$N_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor		$\gamma_{Ms,N}$ [1]	[-]	2,0							
Characterustic tension resistance, Steel, property class 5.8		$N_{Rk,s}$	[kN]	18	29	42	78	122	176	230	280
Characteristic tension resistance, Steel, property class 8.8		$N_{Rk,s}$	[kN]	29	46	67	125	196	282	368	449
Partial safety factor		$\gamma_{Ms,N}$ [1]	[-]	1,50							
Characteristic tension resistance, Stainless steel A4 and HCR poperty class 50 (>M24) and 70 (≤ M24)		$N_{Rk,s}$	[kN]	26	41	59	110	171	247	230	281
Partial safety factor		$\gamma_{Ms,N}$ [1]	[-]	1,87						2,86	
Combined pull-out and concrete failure											
Characteristic bond resistance in non-cracked concrete C20/25											
Temperature range I[5]: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	11	10	9
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	7,5	8,5	8,5	8,5	not admissible			
Temperature range II[5]: 80°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,5	9	9	9	9	8,5	7,5	6,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	not admissible			
Temperature range III[5]: 120°C/72°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	5,5	5,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	4,0	5,0	5,0	5,0	not admissible			
Increasing factors for concrete		ψ_c	C30/37	1,04							
			C40/50	1,08							
			C50/60	1,10							
Factor acc. to CEN/TS 1992-4-5, Section 6.2.2.3		k_8	[-]	10,1							
Concrete cone failure											
Factor acc. to CEN/TS 1992-4-5, Section 6.2.3.1		k_{ucr}	[-]	10,1							
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}							
Axial distance		$s_{cr,N}$	[mm]	3 h_{ef}							
Splitting failure											
Edge distance		$c_{cr,sp}$	[mm]	$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2{,}5 - \frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$							
Axial distance		$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$							
Partial safety factor (dry and wet concrete)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1]	[-]	1,5[2]	1,8[3]						
Partial safety factor (flooded bore hole)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1]	[-]	2,1[4]	not admissible						

[1] In absence of other national regulations
[2] The partial safety factor γ_2 = 1.0 is included.
[3] The partial safety factor γ_2 = 1.2 is included.
[4] The partial safety factor γ_2 = 1.4 is included.
[5] Explanations see section 1.2

MKT Injection System VMU plus for concrete

Application with threaded rod, Design acc. to CEN/TS 1992-4, Characteristic values for tension loads in non-cracked concrete under static and quasi-static action

Annex 15

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Table 14: Design according to CEN/TS 1992-4, Characteristic values for tension loads in cracked concrete under static and quasi-static action

Anchor size threaded rod				**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure									
Characteristic tension resistance, Steel, property class 4.6		$N_{Rk,s}$	[kN]	34	63	98	141	184	224
Partial safety factor		$\gamma_{Ms,N}$ [1]	[-]	2,0					
Characteristic tension resistance, Steel, property class 5.8		$N_{Rk,s}$	[kN]	42	78	122	176	230	280
Characteristic tension resistance, Steel, property class 8.8		$N_{Rk,s}$	[kN]	67	125	196	282	368	449
Partial safety factor		$\gamma_{Ms,N}$ [1]	[-]	1,50					
Chracteristic tension resistance, Stainless steel A4 and HCR property class 50 (>M24) and 70 (≤ M24)		$N_{Rk,s}$	[kN]	59	110	171	247	230	281
Partial safety factor		$\gamma_{Ms,N}$ [1]	[-]	1,87				2,86	
Combined pull-out and concrete failure									
Characteristic bond resistance in cracked concrete C20/25									
Temperature range I [4]: 40°C/24°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	5,5	5,5	5,5	5,5	6,5	6,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	6,0	6,0	not admissible			
Temperature range II [4]: 80°C/50°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	4,0	4,0	4,0	4,0	4,5	4,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	not admissible			
Temperature range III [4]: 120°C/72°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	3,0	3,0	3,0	3,0	3,5	3,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	not admissible			
Increasing factors for concrete		ψ_c	C30/37	1,04					
			C40/50	1,08					
			C50/60	1,10					
Factor acc. to CEN/TS 1992-4-5, Section 6.2.2.3		k_8	[-]	7,2					
Concrete cone failure									
Factor acc. to CEN/TS 1992-4-5, Section 6.2.3.1		k_{cr}	[-]	7,2					
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}					
Axial distance		$s_{cr,N}$	[mm]	3,0 h_{ef}					
Splitting failure									
Edge distance		$c_{cr,sp}$	[mm]	$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2{,}5 - \frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$					
Axial distance		$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$					
Partial safety factor (dry and wet concrete)	$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1]		[-]	1,8 [2]					
Partial safety factor (flooded bore hole)	$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1]		[-]	2,1 [3]		not admissible			

[1] In absence of other national regulations
[2] The partial safety factor $\gamma_2 = 1.2$ is included.
[3] The partial safety factor $\gamma_2 = 1.4$ is included.
[4] Explanations see section 1.2

MKT Injection System VMU plus for concrete

Application with threaded rod, Design acc. to CEN/TS 1992-4, Characteristic tension loads in cracked concrete under static and quasi-static action

Annex 16

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Table 15: Design according to CEN/TS 1992-4, Characteristic values for shear loads in cracked and non-cracked concrete under static and quasi-static action

Anchor size threaded rod			M 8	M 10	M 12	M 16	M 20	M 24	M 27	M 30
Steel failure without lever arm										
Characteristic shear resistance, Steel, property class 4.6	$V_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,67							
Charactertistic shear resistance, Steel, property class 5.8	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Characteristic shear resistance, Steel, property class 8.8	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,25							
Characteristic shear resistance, Stainless steel A4 and HCR Property class 50 (>M24) and 70 (≤ M24)	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	115	140
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,56						2,38	
Ductility factor according to CEN/TS 1992-4-5, Section 6.3.2.1	k_2	[-]	0,8							
Steel failure with lever arm										
Characteristic bending moment, Steel, property class 4.6	$M^0_{Rk,s}$	[Nm]	15	30	52	133	260	449	666	900
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,67							
Characteristic bending moment, Steel, property class 5.8	$M^0_{Rk,s}$	[Nm]	19	37	65	166	324	560	833	1123
Characteristic bending moment, Steel, property class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	896	1333	1797
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,25							
Characteristic bending moment, Stainless steel A4 and HCR property class 50 (>M24) and 70 (≤ M24)	$M^0_{Rk,s}$	[Nm]	26	52	92	232	454	784	832	1125
Partial safety factor	$\gamma_{Ms,V}$ [1]	[-]	1,56						2,38	
Concrete pry-out failure										
Factor in equation (27) of CEN/TS 1992-4-5, Section 6.3.3	k_3	[-]	2,0							
Partial safety factor	γ_{Mcp} [1]	[-]	1,50 [2]							
Concrete edge failure [3]										
Effective length of anchor	l_f	[mm]	$l_f = \min(h_{ef}; 8\ d_{nom})$							
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16	20	24	27	30
Partial safety factor	γ_{Mc} [1]	[-]	1,50 [2]							

[1] In absence of other national regulations
[2] The partial safety factor $\gamma_2 = 1.0$ is included.
[3] See CEN/TS 1992-4-5 Section 6.3.4

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Application with threaded rod, Design acc. to CEN/TS 1992-4, Characteristic values for shear loads in cracked and non-cracked concrete under static and quasi-static action

Annex 17

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Table 16: Design according to CEN/TS 1992-4, Characteristic values for tension loads in non-cracked concrete under static and quasi-static action

Anchor size reinforcing bar				**∅ 8**	**∅ 10**	**∅ 12**	**∅ 14**	**∅16**	**∅ 20**	**∅ 25**	**∅ 28**	**∅ 32**
Steel failure												
Characteristic tension resistance, reinforcing bar according to Annex 4		$N_{Rk,s}$	[kN]	$A_s \times f_{uk}$ [6]								
Partial safety factor		$\gamma_{Ms,N}$ [1]	[-]	CEN/TS 1992-4-1, Section 4.4.3.1.1, Eq. (4) [6]								
Combined pull-out concrete failure												
Chracteristic bond restistance in non-cracked concretet C20/25												
Temperature range I[5]: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	12	11	10	8,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	7,5	8,5	8,5	8,5	8,5	not admissible			
Temperature range II[5]: 80°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,5	9	9	9	9	9	8,0	7,0	6,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	not admissible			
Temperature range III[5]: 120°C/72°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	6,0	5,0	4,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	4,0	5,0	5,0	5,0	5,0	not admissible			
Increasing factors for concrete		ψ_c	C30/37	1,04								
			C40/50	1,08								
			C50/60	1,10								
Factor according to CEN/TS 1992-4-5, Section 6.2.2.3		k_8	[-]	10,1								
Concrete cone failure												
Factor according to CEN/TS 1992-4-5, Section 6.2.3.1		k_{ucr}	[-]	10,1								
Edge distance		$c_{cr,N}$	[mm]	$1,5\ h_{ef}$								
Axial distance		$s_{cr,N}$	[mm]	$3\ h_{ef}$								
Splitting failure												
Edge distance		$c_{cr,sp}$	[mm]	$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2{,}5 - \frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$								
Axial distance		$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$								
Partial safety factor (dry and wet concrete)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1]	[-]	1,5[2]	1,8[3]							
Partial safety factor (flooded bore hole)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1]	[-]	2,1[4]				not admissible				

[1] In absence of other national regulations
[2] The partial safety factor $\gamma_2 = 1.0$ is included.
[3] The partial safety factor $\gamma_2 = 1.2$ is included.
[4] The partial safety factor $\gamma_2 = 1.4$ is included.
[5] Explanations see section 1.2
[6] f_{uk}, f_{yk}: see relevant Technical Specification for the reinforcing bar

Regarding design of post-installed rebar as anchor see chapter 4.2

MKT Injection System VMU plus for concrete

Application with reinforcing bar, Design according to CEN/TS 1992-4, Characteristic values for tension loads in non-cracked concrete under static and quasi-static action

Annex 18

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Table 17: Design according to CEN/TS 1992-4, Characteristic values for tension loads in cracked concrete under static and quasi-static action

Anchor size reinforcing bar				**Ø 12**	**Ø 14**	**Ø16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
Steel failure										
Characteristic tension resistance, reinforcing bar according to Annex 4		$N_{Rk,s}$	[kN]	$A_s \times f_{uk}$ [5]						
Partial safety factor		$\gamma_{Ms,N}$ [1]	[-]	CEN/TS 1992-4-1 Section 4.4.3.1.1, Eq. 4 [5]						
Combined pull-out and concrete failure										
Characteristic bond resistance in cracked concrete C20/25										
Temperature range I[4]: 40°C/24°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	5,5	5,5	5,5	5,5	5,5	6,5	6,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	6,0	6,0	6,0	not admissible			
Temperature range II[4]: 80°C/50°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	4,0	4,0	4,0	4,0	4,0	4,5	4,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	4,5	4,5	4,5	not admissible			
Temperature range III[4]: 120°C/72°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	3,0	3,0	3,0	3,0	3,0	3,5	3,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	3,5	3,5	3,5	not admissible			
Increasing factors for concrete		ψ_c	C30/37	1,04						
			C40/50	1,08						
			C50/60	1,10						
Factor according to CEN/TS 1992-4-5, Section 6.2.2.3		k_8	[-]	7,2						
Concrete cone failure										
Factor according to CEN/TS 1992-4-5, Section 6.2.3.1		k_{cr}	[-]	7,2						
Edge distance		$c_{cr,N}$	[mm]	$1{,}5\ h_{ef}$						
Axial distance		$s_{cr,N}$	[mm]	$3{,}0\ h_{er}$						
Splitting failure										
Edge distance		$c_{cr,sp}$	[mm]	$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2{,}5 - \frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$						
Axial distance		$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$						
Partial safety factor (dry and wet concrete)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1]	[-]	1,8[2]						
Partial safety factor (flooded bore hole)		$\gamma_{Msp} = \gamma_{Mc} = \gamma_{Mp}$ [1]	[-]	2,1[3]			not admissible			

[1] In absence of other national regulations
[2] The partial safety factor $\gamma_2 = 1.2$ is included.
[3] The partial safety factor $\gamma_2 = 1.4$ is included.
[4] Explanations see section 1.2
[5] f_{uk}, f_{yk}: see relevant Technical Specification for the reinforcing bar

Regarding design of post-installed rebar as anchor see chapter 4.2

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Application with reinforcing bar, Design acc. to CEN/TS 1992-4, Characteristic values for tension loads in cracked concrete under static and quasi-static action

Annex 19

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Table 18: Design according to CEN/TS 1992-4, Characteristic values for shear loads in cracked and non-cracked concrete under static and quasi-static action

Anchor size reinforcing bar			**∅ 8**	**∅ 10**	**∅ 12**	**∅ 14**	**∅ 16**	**∅ 20**	**∅ 25**	**∅ 28**	**∅ 32**
Steel failure without lever arm (Properties acc. to Annex 4)											
Characteristic shear resistance, reinforcing bar according to Annex 4	$V_{Rk,s}$	[kN]	$0,5 \times A_s \times f_{uk}$ [4)]								
Partial safety factor	$\gamma_{Ms,V}$ [1)]	[-]	CEN/TS 1992-4-1, Section 4.4.3.1.1, Eq. 5 + 6 [4)]								
Ductility factor according to CEN/TS 1992-4-5, Section 6.3.2.1	k_2	[-]	0,8								
Steel failure with lever arm (Properties acc. to Annex 4)											
Characteristic bending moment, reinforcing bar acc. to Annex 4	$M^0_{Rk,s}$	[Nm]	$1,2 \times W_{el} \times f_{uk}$ [4)]								
Partial safety factor	$\gamma_{Ms,V}$ [1)]	[-]	CEN/TS 1992-4-1, Section 4.4.3.1.1, Eq. 5 + 6 [4)]								
Concrete pry-out failure											
Factor in equation (27) of CEN/TS 1992-4-5, Section 6.3.3	k_3	[-]	2,0								
Partial safety factor	γ_{Mcp} [1)]	[-]	1,50 [2)]								
Concrete edge failure [3)]											
Effective length of anchor	l_f	[mm]	$l_f = \min(h_{ef}; 8\ d_{nom})$								
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	14	16	20	24	27	30
Partial safety factor	γ_{Mc} [1)]	[-]	1,50 [2)]								

[1)] In absence of other national regulations
[2)] The partial safety factor $\gamma_2 = 1.0$ is included.
[3)] See CEN/TS 1992-4-5 Section 6.3.4
[4)] f_{uk}, f_{yk}: see relevant Technical Specification for the reinforcing bar

Regarding design of post-installed rebar as anchor see chapter 4.2

MKT Injection System VMU plus for concrete

Application with reinforcing bar, Design acc. to CEN/TS 1992-4, Characteristic values for shear loads in cracked and non-cracked concrete under static and quasi-static

Annex 20

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Table 19: Displacements for tension loads threaded rod [1)]

Anchor size threaded rod			M 8	M 10	M 12	M 16	M 20	M 24	M 27	M 30
Non-cracked concrete C20/25										
40°C/24°C [2)]	δ_{N0}	[mm/(N/mm²)]	0,021	0,023	0,026	0,031	0,036	0,041	0,045	0,049
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,030	0,033	0,037	0,045	0,052	0,060	0,065	0,071
80°C/50°C [2)]	δ_{N0}	[mm/(N/mm²)]	0,050	0,056	0,063	0,075	0,088	0,100	0,110	0,119
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,072	0,081	0,090	0,108	0,127	0,145	0,159	0,172
120°C/72°C [2)]	δ_{N0}	[mm/(N/mm²)]	0,050	0,056	0,063	0,075	0,088	0,100	0,110	0,119
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,072	0,081	0,090	0,108	0,127	0,145	0,159	0,172
Cracked concrete C20/25										
40°C/24°C [2)]	δ_{N0}	[mm/(N/mm²)]	-	0,070						
	$\delta_{N\infty}$	[mm/(N/mm²)]		0,105						
80°C/50°C [2)]	δ_{N0}	[mm/(N/mm²)]	-	0,170						
	$\delta_{N\infty}$	[mm/(N/mm²)]		0,245						
120°C/72°C [2)]	δ_{N0}	[mm/(N/mm²)]	-	0,170						
	$\delta_{N\infty}$	[mm/(N/mm²)]		0,245						

[1)] Calculation of the displacement for design load
Displacement for short term load = $\delta_{N0} \cdot \tau_{Sd} / 1,4$;
Displacement for long term load = $\delta_{N\infty} \cdot \tau_{Sd} / 1,4$;
(τ_{Sd}: design bond strength)
[2)] Explanations see section 1.2

Table 20: Displacements for shear loads threaded rod [3)]

Anchor size threaded rod			M 8	M 10	M 12	M 16	M 20	M 24	M 27	M 30
Non-cracked concrete C20/25										
All temperatures	δ_{V0}	[mm/(kN)]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
	$\delta_{V\infty}$	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05
Cracked concrete C20/25										
All temperatures	δ_{V0}	[mm/(kN)]	-	0,11	0,10	0,09	0,08	0,08	0,07	
	$\delta_{V\infty}$	[mm/(kN)]		0,17	0,15	0,14	0,13	0,12	0,10	

[3)] Calculation of the displacement for design load
Displacement for short term load = $\delta_{V0} \cdot V_d / 1,4$;
Displacement for long term load = $\delta_{V\infty} \cdot V_d / 1,4$;
(V_d: design shear load)

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Application with threaded rod
Verschiebungen

Annex 21

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Table 21: Displacements for tension loads reinforcing bar [1)]

Anchor size reinforcing bar			∅ 8	∅ 10	∅ 12	∅ 14	∅ 16	∅ 20	∅ 25	∅ 28	∅ 32
Non-cracked concrete C20/25											
40°C/24°C [2)]	δ_{N0}	[mm/(N/mm²)]	0,021	0,023	0,026	0,028	0,031	0,036	0,043	0,047	0,052
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,030	0,033	0,037	0,041	0,045	0,052	0,061	0,071	0,075
80°C/50°C [2)]	δ_{N0}	[mm/(N/mm²)]	0,050	0,056	0,063	0,069	0,075	0,088	0,104	0,113	0,126
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,072	0,081	0,090	0,099	0,108	0,127	0,149	0,163	0,181
120°C/72°C [2)]	δ_{N0}	[mm/(N/mm²)]	0,050	0,056	0,063	0,069	0,075	0,088	0,104	0,113	0,126
	$\delta_{N\infty}$	[mm/(N/mm²)]	0,072	0,081	0,090	0,099	0,108	0,127	0,149	0,163	0,181
Cracked concrete C20/25											
40°C/24°C [2)]	δ_{N0}	[mm/(N/mm²)]	-	0,070							
	$\delta_{N\infty}$	[mm/(N/mm²)]		0,105							
80°C/50°C [2)]	δ_{N0}	[mm/(N/mm²)]	-	0,170							
	$\delta_{N\infty}$	[mm/(N/mm²)]		0,245							
120°C/72°C [2)]	δ_{N0}	[mm/(N/mm²)]	-	0,170							
	$\delta_{N\infty}$	[mm/(N/mm²)]		0,245							

[1)] Calculation of the displacement for design load
Displacement for short term load = $\delta_{N0} \cdot \tau_{Sd} / 1,4$;
Displacement for long term load = $\delta_{N\infty} \cdot \tau_{Sd} / 1,4$;
(τ_{Sd}: design bond strength)
[2)] Explanations see section 1.2

Table 22: Displacements for shear loads reinforcing bar [3)]

Anchor size reinforcing bar			∅ 8	∅ 10	∅ 12	∅ 14	∅ 16	∅ 20	∅ 25	∅ 28	∅ 32
Non-cracked concrete C20/25											
All temperatures	δ_{V0}	[mm/(kN)]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03
	$\delta_{V\infty}$	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,04	0,04
Cracked concrete C20/25											
All temperatures	δ_{V0}	[mm/(kN)]	-		0,11	0,11	0,10	0,09	0,08	0,07	0,06
	$\delta_{V\infty}$	[mm/(kN)]			0,17	0,16	0,15	0,14	0,12	0,11	0,10

[3)] Calculation of the displacement for design load
Displacement for short term load = $\delta_{V0} \cdot V_d / 1,4$;
Displacement for long term load = $\delta_{V\infty} \cdot V_d / 1,4$;
(V_d: design shear load)

MKT Injection System VMU plus for concrete

Application with reinforcing bar
Displacements

Annex 22

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Table 24: Reduction factors $\alpha_{N,seis}$ and $\alpha_{V,seis}$ for seismic design categorie C1 for threaded rods

Anchor size threaded rods			M12	M16	M20	M24	M27	M30
Tension load								
Steel failure ($N_{Rk,s}$)	$\alpha_{N,seis}$	[-]	1,0					
Combined pull-out and concrete failure ($N_{Rk,p}$)	$\alpha_{N,seis}$	[-]	0,68			0,69		
Shear load								
Steel failure without lever arm ($V_{Rk,s}$)	$\alpha_{V,seis}$	[-]	0,70					

Table 25: Reduction factors $\alpha_{N,seis}$ and $\alpha_{V,seis}$ for seismic design category C1 for reinforcing bar

Anchor size reinforcing bar			∅ 12	∅ 14	∅ 16	∅ 20	∅ 25	∅ 28	∅ 32
Tension load									
Steel failure ($N_{Rk,s}$)	$\alpha_{N,seis}$	[-]	1,0						
Combined pull-out and concrete failure ($N_{Rk,p}$)	$\alpha_{N,seis}$	[-]	0,68				0,69		
Shear load									
Steel failure without lever arm ($V_{Rk,s}$)	$\alpha_{V,seis}$	[-]	0,70						

Table 26: Reduction factors α_{gap} and α_{seis} for resistance under seismic actions

Loading	Versagensart	α_{gap}	α_{seis} – Einzelbefestigung	α_{seis} – Gruppenbefestigung
Tension	Steel failure	1,0	1,0	1,0
	Pull-out failure	1,0	1,0	0,85
	Combined pull-out and concrete failure	1,0	1,0	0,85
	Concrete cone failure	1,0	0,85	0,75
	Splitting failure	1,0	1,0	0,85
Shear	Steel failure without lever arm	0,5 [1)]	1,0	0,85
	Steel failure with lever arm	NPD [2)]	NPD [2)]	NPD [2)]
	Concrete edge failure	0,5 [1)]	1,0	0,85
	Concrete pry-out failure	0,5 [1)]	0,85	0,75

1) The limitation for size of the clearance hole is given in TR 029 Table 4.1, α_{gap} = 1,0 in case of no clearance between fastener and fixture

2) No Performance Determined

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Design according to TR 045; Reduction factors

Annex 24