... eine starke Verbindung

DEKLARACJA WŁAŚCIWOŚCI UŻYTKOWYCH
DoP Nr. MKT-113 - pl

1. Niepowtarzalny kod identyfikacyjny typu wyrobu: **MKT Bolzenanker BZ plus & BZ-IG**

2. Numer typu, partii lub serii lub jakikolwiek inny element umożliwiający identyfikację wyrobu budowlanego, wymagany zgodnie z art. 11 ust. 4:
ETA-99/0010, 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 rozporowa z kontrolowanym momentem dokręcania (typ sworzniowy)
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 BZ plus M8, M10, M12, M16, M20)
materiał	<u>stal ocynkowana galwanicznie:</u> zastosowanie tylko w suchych warunkach o rozmiarach: BZ plus: M8, M10, M12, M16, M20, M24, M27 BZ-IG: M6, M8, M10, M12 <u>stal dyfuzja galwanicznie:</u> zastosowanie tylko w suchych warunkach o rozmiarach: BZ plus: M10, M12, M16, M20 <u>stal nierdzewna (oznaczenie A4):</u> do zastosowania wewnątrz i na zewnątrz budynków bez szczególnie agresywnych warunków o rozmiarach: BZ plus: M8, M10, M12, M16, M20, M24 BZ-IG: M6, M8, M10, M12 <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: BZ plus: M8, M10, M12, M16, M20, M24 BZ-IG: M6, M8, M10, M12
zakres temperaturowy jeśli dotyczy	--

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-99/0010

na podstawie

ETAG 001-2

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 550-1

9. Deklarowane właściwości użytkowe:

Zasadnicze charakterystyki	**Metoda projektowa**	**Właściwości użytkowe**		**Zharmonizowana specyfikacja techniczna**
		BZ plus	**BZ-IG**	
nośność charakterystyczna na wyrywanie	ETAG 001, załącznik C CEN/TS 1992-4	załącznik C1-C4	załącznik C11-C12	ETAG 001
nośność charakterystyczna na ścinanie	ETAG 001, załącznik C CEN/TS 1992-4	załącznik C5	załącznik C13	
nośność charakterystyczna na sejsmiczny żądanie	TR 045	załącznik C6	NPD	
przemieszczenie w stanie granicznym użytkowania	ETAG 001, załącznik C CEN/TS 1992-4	załącznik C9-C10	załącznik C15	
nośność charakterystyczna na działaniu ognia	TR 020 CEN/TS 1992-4	załącznik C7-C8	załącznik C14	

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
(Kierownik)
Weilerbach, 21.04.2016

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

Table C1: Characteristic values for **tension loads,** BZ plus **zinc plated, cracked concrete,** static and quasi-static action

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0						
Steel failure									
Characteristic tension resistance	$N_{Rk,s}$	[kN]	16	27	40	60	86	126	196
Partial safety factor	γ_{Ms}	[-]	1,53		1,5		1,6	1,5	
Pull-out									
Standard anchorage depth									
Characteristic resistance in concrete C20/25	$N_{Rk,p}$	[kN]	5	9	16	25	1)	1)	1)
Reduced anchorage depth									
Characteristic resistance in concrete C20/25	$N_{Rk,p}$	[kN]	5	7,5	1)	1)	-	-	-
Increasing factor for $N_{Rk,p}$	ψc	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$						
Concrete cone failure									
Effective anchorage depth	h_{ef}	[mm]	46	60	70	85	100	115	125
Reduced anchorage depth	$h_{ef,red}$	[mm]	35 2)	40	50	65	-	-	-
Factor acc. to CEN/TS 1992-4	k_{cr}	[-]	7,2						

1) Pull-out is not decisive.
2) Use restricted to anchoring of structural components statically indeterminate.

Table C2: Characteristic values for **tension loads,** BZ plus **A4 / HCR, cracked concrete,** static and quasi-static action

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0					
Steel failure								
Characteristic tension resistance	$N_{Rk,s}$	[kN]	16	27	40	64	108	110
Partial safety factor	γ_{Ms}	[-]	1,5				1,68	1,5
Pull-out								
Standard anchorage depth								
Characteristic resistance in concrete C20/25	$N_{Rk,p}$	[kN]	5	9	16	25	1)	40
Reduced anchorage depth								
Characteristic resistance in concrete C20/25	$N_{Rk,p}$	[kN]	5	7,5	1)	1)	-	-
Increasing factor for $N_{Rk,p}$	ψc	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$					
Concrete cone failure								
Effective anchorage depth	h_{ef}	[mm]	46	60	70	85	100	125
Reduced anchorage depth	$h_{ef,red}$	[mm]	35 2)	40	50	65	-	-
Factor according to CEN/TS 1992-4	k_{cr}	[-]	7,2					

1) Pull-out is not decisive.
2) Use restricted to anchoring of structural components statically indeterminate.

Table C3: Characteristic values for **tension loads,** BZ plus **zinc plated, non-cracked concrete,** static and quasi-static action

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0						
Steel failure									
Characteristic tension resistance	$N_{Rk,s}$	[kN]	16	27	40	60	86	126	196
Partial safety factor	γ_{Ms}	[-]	1,53		1,5		1,6	1,5	
Pull-out									
Standard anchorage depth									
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	12	16	25	35	1)	1)	1)
Reduced anchorage depth									
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	7,5	9	1)	1)	-	-	-
Splitting For the proof against splitting failure $N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$ with consideration of the member thickness									
Standard anchorage depth									
Splitting for **standard thickness of concrete member** (The higher resistance of case 1 and case 2 may be applied; the values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min,2} < h < h_{min,1}$ (Case 2); $\psi_{h,sp} = 1,0$))									
Standard thickness of concrete	$h_{min,1} \geq$	[mm]	100	120	140	170	200	230	250
Case 1									
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	9	12	20	30	40	62,3	50
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	3 h_{ef}						
Case 2									
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	12	16	25	35	50,5	62,3	70,6
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	4 h_{ef}				4,4 h_{ef}	3 h_{ef}	5 h_{ef}
Splitting for **minimum thickness of concrete member**									
Minimum thickness of concrete	$h_{min,2} \geq$	[mm]	80	100	120	140	-	-	-
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	12	16	25	35			
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	5 h_{ef}						
Reduced anchorage depth									
Minimum thickness of concrete	$h_{min,3} \geq$	[mm]	80	80	100	140	-	-	-
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	7,5	9	17,9	26,5			
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	200	200	250	300			
Increasing factor for $N_{Rk,p}$ and $N^0_{Rk,sp}$	ψc	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$						
Concrete cone failure									
Effective anchorage depth	h_{ef}	[mm]	46	60	70	85	100	115	125
Reduced anchorage depth	$h_{ef,red}$	[mm]	35 2)	40	50	65	-	-	-
Factor according to CEN/TS 1992-4	k_{ucr}	[-]	10,1						

1) Pull-out is not decisive.
2) Use restricted to anchoring of structural components statically indeterminate.

Wedge Anchor BZ plus

Performance
Characteristic values for **tension loads,** BZ plus **zinc plated, non-cracked concrete,** static and quasi-static action

Annex C3

Table C4: Characteristic values for **tension loads,** BZ plus **A4 / HCR, non-cracked concrete,** static and quasi-static action

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0					
Steel failure								
Characteristic tension resistance	$N_{Rk,s}$	[kN]	16	27	40	64	108	110
Partial safety factor	γ_{Ms}	[-]	1,5				1,68	1,5
Pull-out								
Standard anchorage depth								
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	12	16	25	35	1)	1)
Reduced anchorage depth								
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	7,5	9	1)	1)	-	-
Splitting For the proof against splitting failure $N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$ with consideration of the member thickness								
Standard anchorage depth								
Splitting for **standard thickness of concrete member** (The higher resistance of case 1 and case 2 may be applied; the values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min,2} < h < h_{min,1}$ (Case 2); $\psi_{h,sp}$= 1,0)								
Standard thickness of concrete	$h_{min,1} \geq$	[mm]	100	120	140	160	200	250
Case 1								
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	9	12	20	30	40	-
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	3 h_{ef}					
Case 2								
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	12	16	25	35	50,5	70,6
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	230	250	280	400	440	500
Splitting for **minimum thickness of concrete member**								
Minimum thickness of concrete	$h_{min,2} \geq$	[mm]	80	100	120	140	-	-
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	12	16	25	35		
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	5 h_{ef}					
Reduced anchorage depth								
Minimum thickness of concrete	$h_{min,3} \geq$	[mm]	80	80	100	140	-	-
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	7,5	9	17,9	26,5		
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	200	200	250	300		
Increasing factor for $N_{Rk,p}$ and $N^0_{Rk,sp}$	ψc	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$					
Concrete cone failure								
Effective anchorage depth	h_{ef}	[mm]	46	60	70	85	100	125
Reduced anchorage depth	$h_{ef,red}$	[mm]	35 2)	40	50	65	-	-
Factor according to CEN/TS 1992-4	k_{ucr}	[-]	10,1					

1) Pull-out is not decisive.
2) Use restricted to anchoring of structural components statically indeterminate.

Wedge Anchor BZ plus

Performance
Characteristic values for **tension loads,** BZ plus **A4 / HCR, non-cracked concrete,** static and quasi-static action

Annex C4

Table C5: Characteristic values for **shear loads**, BZ plus, **cracked** and **non-cracked concrete,** static or quasi static action

Anchor size				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**
Installation safety factor		$\gamma_2 = \gamma_{inst}$	[-]	1,0						
Steel failure without lever arm, Steel zinc plated										
Characteristic shear resistance		$V_{Rk,s}$	[kN]	12,2	20,1	30	55	69	114	169,4
Factor for ductility		k_2	[-]	1,0						
Partial safety factor		γ_{Ms}	[-]	1,25				1,33	1,25	1,25
Steel failure without lever arm, Stainless steel A4, HCR										
Characteristic shear resistance		$V_{Rk,s}$	[kN]	13	20	30	55	86	123,6	-
Factor for ductility		k_2	[-]	1,0						
Partial safety factor		γ_{Ms}	[-]	1,25				1,4	1,25	
Steel failure with lever arm, Steel zinc plated										
Characteristic bending resistance		$M^0_{Rk,s}$	[Nm]	23	47	82	216	363	898	1331,5
Partial safety factor		γ_{Ms}	[-]	1,25				1,33	1,25	1,25
Steel failure with lever arm, Stainless steel A4, HCR										
Characteristic bending resistance		$M^0_{Rk,s}$	[Nm]	26	52	92	200	454	785,4	-
Partial safety factor		γ_{Ms}	[-]	1,25				1,4	1,25	
Concrete pry-out failure										
Factor k acc. to ETAG 001, Annex C or k_3 acc. to CEN/TS 1992-4		$k_{(3)}$	[-]	2,4				2,8		
Concrete edge failure										
Effective length of anchor in shear loading with $\mathbf{h_{ef}}$	Steel zinc plated	l_f	[mm]	46	60	70	85	100	115	125
	Stainless steel A4, HCR	l_f	[mm]	46	60	70	85	100	125	-
Effective length of anchor in shear loading with $\mathbf{h_{ef,red}}$	Steel zinc plated	$l_{f,red}$	[mm]	35[1)]	40	50	65	-	-	-
	Stainless steel A4, HCR	$l_{f,red}$	[mm]	35[1)]	40	50	65			
Outside diameter of anchor		d_{nom}	[mm]	8	10	12	16	20	24	27

[1)] Use restricted to anchoring of structural components statically indeterminate.

Table C6: Characteristic resistance for **seismic loading**, BZ plus, **standard anchorage depth,** performance category **C1** and **C2**

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**
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]	16	27	40	60	86
Characteristic resistance **C2**	$N_{Rk,s,seis,C2}$	[kN]	16	27	40	60	86
Partial safety factor	$\gamma_{Ms,seis}$	[-]	1,53		1,5		1,6
Steel failure, Stainless steel A4, HCR							
Characteristic resistance **C1**	$N_{Rk,s,seis,C1}$	[kN]	16	27	40	64	108
Characteristic resistance **C2**	$N_{Rk,s,seis,C2}$	[kN]	16	27	40	64	108
Partial safety factor	$\gamma_{Ms,seis}$	[-]	1,5				1,68
Pull-out (steel zinc plated, stainless steel A4 and HCR)							
Characteristic resistance **C1**	$N_{Rk,p,seis,C1}$	[kN]	5	9	16	25	36
Characteristic resistance **C2**	$N_{Rk,p,seis,C2}$	[kN]	2,3	3,6	10,2	13,8	24,4
Increasing factor for $N_{Rk,p}$	ψc	[-]	1,0				
Shear loads							
Steel failure without lever arm, Steel zinc plated							
Characteristic resistance **C1**	$V_{Rk,s,seis,C1}$	[kN]	9,3	20	27	44	69
Characteristic resistance **C2**	$V_{Rk,s,seis,C2}$	[kN]	6,7	14	16,2	35,7	55,2
Partial safety factor	$\gamma_{Ms,seis}$	[-]	1, 25				1,33
Steel failure without lever arm, Stainless steel A4, HCR							
Characteristic resistance **C1**	$V_{Rk,s,seis,C1}$	[kN]	9,3	20	27	44	69
Characteristic resistance **C2**	$V_{Rk,s,seis,C2}$	[kN]	6,7	14	16,2	35,7	55,2
Partial safety factor	$\gamma_{Ms,seis}$	[-]	1, 25				1,4

Table C7: Characteristic values **for tension and shear load** under **fire exposure,** BZ plus, **standard anchorage depth,** cracked and non-cracked concrete C20/25 to C50/60

Anchor size				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**
Tension load										
Steel failure										
Steel, galvanised										
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	1,5	2,6	4,1	7,7	9,4	13,6	17,6
	R60			1,1	1,9	3,0	5,6	8,2	11,8	15,3
	R90			0,8	1,4	2,4	4,4	6,9	10,0	13,0
	R120			0,7	1,2	2,2	4,0	6,3	9,1	11,8
Stainless steel A4, HCR										
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	3,8	6,9	12,7	23,7	33,5	48,2	-
	R60			2,9	5,3	9,4	17,6	25,0	35,9	
	R90			2,0	3,6	6,1	11,5	16,4	23,6	
	R120			1,6	2,8	4,5	8,4	12,1	17,4	
Shear load										
Steel failure without lever arm										
Steel, galvanised										
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	1,6	2,6	4,1	7,7	11	16	20,6
	R60			1,5	2,5	3,6	6,8	11	15	19,8
	R90			1,2	2,1	3,5	6,5	10	15	19,0
	R120			1,0	2,0	3,4	6,4	10	14	18,6
Stainless steel A4, HCR										
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	3,8	6,9	12,7	23,7	33,5	48,2	-
	R60			2,9	5,3	9,4	17,6	25,0	35,9	
	R90			2,0	3,6	6,1	11,5	16,4	23,6	
	R120			1,6	2,8	4,5	8,4	12,1	17,4	
Steel failure with lever arm										
Steel, galvanised										
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,7	3,3	6,4	16,3	29	50	75
	R60			1,6	3,2	5,6	14	28	48	72
	R90			1,2	2,7	5,4	14	27	47	69
	R120			1,1	2,5	5,3	13	26	46	68
Stainless steel A4, HCR										
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	3,8	9,0	19,7	50,1	88,8	153,5	-
	R60			2,9	6,8	14,6	37,2	66,1	114,3	
	R90			2,1	4,7	9,5	24,2	43,4	75,1	
	R120			1,6	3,6	7,0	17,8	32,1	55,5	

The characteristic resistance for pull-out failure, concrete cone failure, concrete pry-out and concrete edge failure can be calculated according to TR020 / CEN/TS 1992-4. If pull-out is not decisive in Eq. 2.4 and Eq. 2.5, TR 020 $N_{Rk,p}$ must be replaced by $N^0_{Rk,c.}$.

Table C8: Characteristic values **for tension and shear load** under **fire exposure,** BZ plus, **reduced anchorage depth,** cracked and non-cracked concrete C20/25 to C50/60

Anchor size				**M8**	**M10**	**M12**	**M16**
Tension load							
Steel failure							
Steel, galvanised							
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	1,5	2,6	4,1	7,7
	R60			1,1	1,9	3,0	5,6
	R90			0,8	1,3	1,9	3,5
	R120			0,6	1,0	1,3	2,5
Stainless steel A4, HCR							
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	3,2	6,9	12,7	23,7
	R60			2,5	5,3	9,4	17,6
	R90			1,9	3,6	6,1	11,5
	R120			1,6	2,8	4,5	8,4
Shear load							
Steel failure without lever arm							
Steel, galvanised							
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	1,5	2,6	4,1	7,7
	R60			1,1	1,9	3,0	5,6
	R90			0,8	1,3	1,9	3,5
	R120			0,6	1,0	1,3	2,5
Stainless steel A4, HCR							
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	3,2	6,9	12,7	23,7
	R60			2,5	5,3	9,4	17,6
	R90			1,9	3,6	6,1	11,5
	R120			1,6	2,8	4,5	8,4
Steel failure with lever arm							
Steel, galvanised							
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,5	3,3	6,4	16,3
	R60			1,2	2,5	4,7	11,9
	R90			0,8	1,7	3,0	7,5
	R120			0,6	1,2	2,1	5,3
Stainless steel A4, HCR							
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	3,2	8,9	19,7	50,1
	R60			2,6	6,8	14,6	37,2
	R90			2,0	4,7	9,5	24,2
	R120			1,6	3,6	7,0	17,8

The characteristic resistance for pull-out failure, concrete cone failure, concrete pry-out and concrete edge failure can be calculated according to TR020 / CEN/TS 1992-4. If pull-out is not decisive in Eq. 2.4 and Eq. 2.5, TR 020 $N_{Rk,p}$ must be replaced by $N^0_{Rk,c.}$

Table C9: Displacements under tension load, BZ plus

Anchor size			M8	M10	M12	M16	M20	M24	M27
Standard anchorage depth									
Steel zinc plated									
Tension load in cracked concrete	N	[kN]	2,4	4,3	7,6	11,9	17,1	21,1	24
Displacement	δ_{N0}	[mm]	0,6	1,0	0,4	1,0	0,9	0,7	0,9
	$\delta_{N\infty}$	[mm]	1,4	1,2	1,4	1,3	1,0	1,2	1,4
Tension load in non-cracked concrete	N	[kN]	5,7	7,6	11,9	16,7	23,8	29,6	34
Displacement	δ_{N0}	[mm]	0,4	0,5	0,7	0,3	0,4	0,5	0,3
	$\delta_{N\infty}$	[mm]	0,8		1,4	0,8			1,4
Displacements under seismic tension loads **C2**									
Displacements for DLS	$\delta_{N,seis,C2(DLS)}$	[mm]	2,3	4,1	4,9	3,6	5,1	-	-
Displacements for ULS	$\delta_{N,seis,C2(ULS)}$	[mm]	8,2	13,8	15,7	9,5	15,2		
Stainless steel A4, HCR									
Tension load in cracked concrete	N	[kN]	2,4	4,3	7,6	11,9	17,1	19,0	-
Displacement	δ_{N0}	[mm]	0,7	1,8	0,4	0,7	0,9	0,5	
	$\delta_{N\infty}$	[mm]	1,2	1,4	1,4	1,4	1,0	1,8	
Tension load in non-cracked concrete	N	[kN]	5,8	7,6	11,9	16,7	23,8	33,5	-
Displacement	δ_{N0}	[mm]	0,6	0,5	0,7	0,2	0,4	0,5	
	$\delta_{N\infty}$	[mm]	1,2	1,0	1,4	0,4	0,8	1,1	
Displacements under seismic tension loads **C2**									
Displacements for DLS	$\delta_{N,seis,C2(DLS)}$	[mm]	2,3	4,1	4,9	3,6	5,1	-	-
Displacements for ULS	$\delta_{N,seis,C2(ULS)}$	[mm]	8,2	13,8	15,7	9,5	15,2		
Reduced anchorage depth									
Steel zinc plated, stainless steel A4, HCR									
Tension load in cracked concrete	N	[kN]	2,4	3,6	6,1	9,0	-	-	-
Displacement	δ_{N0}	[mm]	0,8	0,7	0,5	1,0			
	$\delta_{N\infty}$	[mm]	1,2	1,0	0,8	1,1			
Tension load in non-cracked concrete	N	[kN]	3,7	4,3	8,5	12,6	-	-	-
Displacement	δ_{N0}	[mm]	0,1	0,2	0,2	0,2			
	$\delta_{N\infty}$	[mm]	0,7	0,7	0,7	0,7			

Table C10: Displacements under shear load, BZ plus

Anchor size			M8	M10	M12	M16	M20	M24	M27
Standard anchorage depth									
Steel zinc plated									
Shear load in cracked and non-cracked concrete	V	[kN]	6,9	11,4	17,1	31,4	36,8	64,9	96,8
Displacement	δ_{V0}	[mm]	2,0	3,2	3,6	3,5	1,8	3,5	3,6
	$\delta_{V\infty}$	[mm]	3,0	4,7	5,5	5,3	2,7	5,3	5,4
Displacements under seismic shear loads **C2**									
Displacements for DLS	$\delta_{V,seis,C2(DLS)}$	[mm]	3,0	2,7	3,5	4,3	4,7	-	-
Displacements for ULS	$\delta_{V,seis,C2(ULS)}$	[mm]	5,9	5,3	9,5	9,6	10,1		
Stainless steel A4, HCR									
Shear load in cracked and non-cracked concrete	V	[kN]	7,3	11,4	17,1	31,4	43,8	70,6	-
Displacement	δ_{V0}	[mm]	1,9	2,4	4,0	4,3	2,9	2,8	
	$\delta_{V\infty}$	[mm]	2,9	3,6	5,9	6,4	4,3	4,2	
Displacements under seismic shear loads **C2**									
Displacements for DLS	$\delta_{V,seis,C2(DLS)}$	[mm]	3,0	2,7	3,5	4,3	4,7	-	-
Displacements for ULS	$\delta_{V,seis,C2(ULS)}$	[mm]	5,9	5,3	9,5	9,6	10,1		
Reduced anchorage depth									
Steel zinc plated									
Shear load in cracked and non-cracked concrete	V	[kN]	6,9	11,4	17,1	31,4	-	-	-
Displacement	δ_{V0}	[mm]	2,0	3,2	3,6	3,5			
	$\delta_{V\infty}$	[mm]	3,0	4,7	5,5	5,3			
Stainless steel A4, HCR									
Shear load in cracked and non-cracked concrete	V	[kN]	7,3	11,4	17,1	31,4	-	-	-
Displacement	δ_{V0}	[mm]	1,9	2,4	4,0	4,3			
	$\delta_{V\infty}$	[mm]	2,9	3,6	5,9	6,4			

Table C11: Characteristic values for **tension loads, BZ-IG, cracked concrete,** static and quasi-static action

Anchor size			**M6**	**M8**	**M10**	**M12**
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,2			
Steel failure						
Characteristic tension resistance, **steel zinc plated**	$N_{Rk,s}$	[kN]	16,1	22,6	26,0	56,6
Partial safety factor	γ_{Ms}	[-]	1,5			
Characteristic tension resistance, **stainless steel A4, HCR**	$N_{Rk,s}$	[kN]	14,1	25,6	35,8	59,0
Partial safety factor	γ_{Ms}	[-]	1,87			
Pull-out failure						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	5	9	12	20
Increasing factor	ψc	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$			
Concrete cone failure						
Effective anchorage depth	h_{ef}	[mm]	45	58	65	80
Factor according to CEN/TS 1992-4	k_{cr}	[-]	7,2			

Table C12: Characteristic values for **tension loads, BZ-IG, non-cracked concrete,** static and quasi-static action

Anchor size			**M6**	**M8**	**M10**	**M12**
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,2			
Steel failure						
Characteristic tension resistance, **steel zinc plated**	$N_{Rk,s}$	[kN]	16,1	22,6	26,0	56,6
Partial safety factor	γ_{Ms}	[-]	1,5			
Characteristic tension resistance, **stainless steel A4, HCR**	$N_{Rk,s}$	[kN]	14,1	25,6	35,8	59,0
Partial safety factor	γ_{Ms}	[-]	1,87			
Pull-out						
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	12	16	20	30
Splitting ($N^0_{Rk,c}$ has to be replaced by $N^0_{Rk,sp}$. The higher resistance of Case 1 and Case 2 may be applied.)						
Minimum thickness of concrete member	h_{min}	[mm]	100	120	130	160
Case 1						
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	9	12	16	25
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	3 h_{ef}			
Case 2						
Characteristic resistance in non-cracked concrete C20/25	$N^0_{Rk,sp}$	[kN]	12	16	20	30
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	5 h_{ef}			
Increasing factor for $N_{Rk,p}$ and $N^0_{Rk,sp}$	ψc	[-]	$\left(\frac{f_{ck,cube}}{25}\right)^{0,5}$			
Concrete cone failure						
Effective anchorage depth	h_{ef}	[mm]	45	58	65	80
Factor according to CEN/TS 1992-4	k_{ucr}	[-]	10,1			

Table C13: Characteristic values for **shear loads, BZ-IG, cracked and non-cracked concrete,** static and quasi-static action

Anchor size			**M6**	**M8**	**M10**	**M12**
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0			
BZ-IG, steel zinc plated						
Steel failure without lever arm, Installation type V						
Characteristic shear resistance	$V_{Rk,s}$	[kN]	5,8	6,9	10,4	25,8
Steel failure without lever arm, Installation type D						
Characteristic shear resistance	$V_{Rk,s}$	[kN]	5,1	7,6	10,8	24,3
Steel failure with lever arm, Installation type V						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	12,2	30,0	59,8	104,6
Steel failure with lever arm, Installation type D						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	36,0	53,2	76,0	207
Partial safety factor for $V_{Rk,s}$ and $M^0_{Rk,s}$	γ_{Ms}	[-]	1,25			
Factor of ductility	k_2	[-]	1,0			
BZ-IG, stainless steel A4, HCR						
Steel failure without lever arm, Installation type V						
Characteristic shear resistance	$V_{Rk,s}$	[kN]	5,7	9,2	10,6	23,6
Partial safety factor	γ_{Ms}	[-]	1,25			
Steel failure without lever arm, Installation type D						
Characteristic shear resistance	$V_{Rk,s}$	[kN]	7,3	7,6	9,7	29,6
Partial safety factor	γ_{Ms}	[-]	1,25			
Steel failure with lever arm, Installation type V						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	10,7	26,2	52,3	91,6
Partial safety factor	γ_{Ms}	[-]	1,56			
Steel failure with lever arm, Installation type D						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	28,2	44,3	69,9	191,2
Partial safety factor	γ_{Ms}	[-]	1,25			
Factor of ductility	k_2	[-]	1,0			
Concrete pry-out failure						
Factor k acc. to ETAG 001, Annex C or k_3 acc. to CEN/TS 1992-4	$k_{(3)}$	[-]	1,5	1,5	2,0	2,0
Concrete edge failure						
Effective length of anchor in shear loading	l_f	[mm]	45	58	65	80
Effective diameter of anchor	d_{nom}	[mm]	8	10	12	16

Table C14: Characteristic values for **tension** and **shear load** under **fire exposure, BZ-IG,** cracked and non-cracked concrete C20/25 to C50/60

Anchor size				**M6**	**M8**	**M10**	**M12**
Tension load							
Steel failure							
Steel zinc plated							
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	0,7	1,4	2,5	3,7
	R60			0,6	1,2	2,0	2,9
	R90			0,5	0,9	1,5	2,2
	R120			0,4	0,8	1,3	1,8
Stainless steel A4, HCR							
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	2,9	5,4	8,7	12,6
	R60			1,9	3,8	6,3	9,2
	R90			1,0	2,1	3,9	5,7
	R120			0,5	1,3	2,7	4,0
Shear load							
Steel failure without lever arm							
Steel zinc plated							
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	0,7	1,4	2,5	3,7
	R60			0,6	1,2	2,0	2,9
	R90			0,5	0,9	1,5	2,2
	R120			0,4	0,8	1,3	1,8
Stainless steel A4, HCR							
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	2,9	5,4	8,7	12,6
	R60			1,9	3,8	6,3	9,2
	R90			1,0	2,1	3,9	5,7
	R120			0,5	1,3	2,7	4,0
Steel failure with lever arm							
Steel zinc plated							
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	0,5	1,4	3,3	5,7
	R60			0,4	1,2	2,6	4,6
	R90			0,4	0,9	2,0	3,4
	R120			0,3	0,8	1,6	2,8
Stainless steel A4, HCR							
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	2,2	5,5	11,2	19,6
	R60			1,5	3,9	8,1	14,3
	R90			0,7	2,2	5,1	8,9
	R120			0,4	1,3	3,5	6,2

The characteristic resistance for pull-out failure, concrete cone failure, concrete pry-out failure and concrete edge failure can be designed according to TR020 / CEN/TS 1992-4.

Table C15: Displacements under tension load, BZ-IG

Anchor size			M6	M8	M10	M12
Tension load in cracked concrete	N	[kN]	2,0	3,6	4,8	8,0
Displacements	δ_{N0}	[mm]	0,6	0,6	0,8	1,0
	$\delta_{N\infty}$	[mm]	0,8	0,8	1,2	1,4
Tension load in non-cracked concrete	N	[kN]	4,8	6,4	8,0	12,0
Displacements	δ_{N0}	[mm]	0,4	0,5	0,7	0,8
	$\delta_{N\infty}$	[mm]	0,8	0,8	1,2	1,4

Table C16: Displacements under shear load, BZ-IG

Anchor size			M6	M8	M10	M12
Shear load in cracked and non-cracked concrete	V	[kN]	4,2	5,3	6,2	16,9
Displacements	δ_{V0}	[mm]	2,8	2,9	2,5	3,6
	$\delta_{V\infty}$	[mm]	4,2	4,4	3,8	5,3