RECA NORM

RECA | HÄLT. WIRKT. BEWEGT.

DECLARAŢIA DE PERFORMANŢĂ
Nr. 0910000002-2015-05

1. Cod unic de identificare al produsului-tip: **conexpand cu şurub BZ plus şi BZ-IG**

2. Tipul, lotul sau numărul de serie sau orice alt element care permite identificarea produsului pentru construcţii astfel cum este solicitat la articolul 11 alineatul (4):

ETA-99/0010, Annex A3, A5
Număr lot: a se vedea ambalajul

3. Utilizarea sau utilizările preconizate ale produsului pentru construcţii, în conformitate cu specificaţia tehnică armonizată aplicabilă, astfel cum este prevăzut de fabricant:

Produs-tip	conexpand cu moment de răsucire controlat (de tip bolţ (cu filet interior))
Pentru utilizarea în	beton fisurat şi nefisurat C20/25 - C50/60 (EN 206)
Opţiune	1
Solicitare	statică şi cvasistatică, seismic, categorie C1+C2 (dimensiuni incluse BZ plus M10, M12, M16, M20)
Material	oţel galvanizat: numai în incinte uscate dimensiuni incluse: BZ plus: M8, M10, M12, M16, M20, M24, M27 BZ-IG: M6, M8, M10, M12 oţel inoxidabil (marcaj A4): în incinte şi în spaţii exterioare fără condiţii deosebit de agresive dimensiuni incluse: BZ plus: M8, M10, M12, M16, M20, M24 BZ-IG: M6, M8, M10, M12 oţel foarte rezistent la coroziune (marcaj HCR): în incinte şi în spaţii exterioare cu condiţii deosebit de agresive dimensiuni incluse: BZ plus: M8, M10, M12, M16, M20, M24 BZ-IG: M6, M8, M10, M12
Interval de temperatură (dacă este cazul)	--

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

RECA NORM GmbH
Am Wasserturm 4
74635 Kupferzell

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

6. Sistemul sau sistemele de evaluare şi verificare a constanţei performanţei produsului pentru construcţii, astfel cum este prevăzut în anexa V: **sistemul 1**

7. În cazul declaraţiei de performanţă privind un produs pentru construcţii acoperit de un standard armonizat:
--

RECA NORM GmbH

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Sitz Kupferzell
Amtsgericht Stuttgart HRB 738108
USt-IdNr. DE146280166

Geschäftsführer
Ulrich Häfele
Ferdinand Pfaller

8. În cazul declaraţiei de performanţă pentru un produs pentru construcţii pentru care s-a emis o evaluare tehnică europeană:

   Deutsches Institut für Bautechnik, Berlin

   a emis:

   ETA-99/0010

   pe baza

   ETAG 001-2

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

   i) stabilirea produsului-tip pe baza unei încercări de tip (inclusiv a unei eşantionări), a unei calculări de tip, a tabelelor cu valori sau a documentelor care conţin descrierea produsului;
   ii) inspecţia iniţială a fabricii şi controlul din fabrică al producţiei;
   iii) supravegherea curentă şi evaluarea controlului din fabrică al producţiei

   şi a emis: Certificatul de conformitate 1343-CPR-M 550-1

9. Performanţa declarată:

Caracteristici esenţiale	Metodă de evaluare	Performanţă		Specificaţie tehnică armonizată
		BZ plus	BZ-IG	
Rezistenţa caracteristică la tracţiune	ETAG 001, Anhang C CEN/TS 1992-4	ETA-99/0010, Annexe C1-C4	ETA-99/0010, Annexe C10-C11	ETAG 001
Rezistenţa caracteristică la forfecare	ETAG 001, Anhang C CEN/TS 1992-4	ETA-99/0010, Annex C5	ETA-99/0010, Annex C12	
Rezistenţa caracteristică la seismic cerere	TR 045	ETA-99/0010, Annex C6	NPD	
Dislocare în stare uzată	ETAG 001, Anhang C CEN/TS 1992-4	ETA-99/0010, Annexe C8-C9	ETA-99/0010, Annex C14	
Rezistenţa caracteristică la efectele de foc	TR 020 CEN/TS 1992-4	ETA-99/0010, Annex C7	ETA-99/0010, Annexe C13	

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

10. Performanţa produsului identificat la punctele 1 şi 2 este în conformitate cu performanţa declarată de la punctul 9.

    Această declaraţie de performanţă este emisă pe răspunderea exclusivă a fabricantului identificat la punctul 4. Semnată pentru şi în numele fabricantului de către:

ppa. Wolfgang Rau, Divisional director Product Management
(name and function)

Kupferzell, 2015-05-22
(place and date of issue)

.....
(signature)

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Geschäftsführer
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Ferdinand Pfaller

Table C1: Characteristic values for **tension loads,** BZ plus **zinc plated, cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

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	$N_{Rk,p,red}$	[kN]	5	7,5	1)	1)			
Increasing factor for $N_{Rk,p}$ and $N_{Rk,p,red}$	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 for cracked concrete	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,
design method A according to ETAG 001, Annex C or CEN/TS 1992-4

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	$N_{Rk,p,red}$	[kN]	5	7,5	1)	1)		
Increasing factor for $N_{Rk,p}$ and $N_{Rk,p,red}$	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 for cracked concrete	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, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

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	$N_{Rk,p,red}$	[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 $h_{min} < h < h_{std}$ (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	1)	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	1)	1)	1)
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	1)	1)			
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	200	200	250	300			
Increasing factor for $N_{Rk,p(red)}$ 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 for non-cracked concrete	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, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

Annex C3

Table C4: Characteristic values for **tension loads,** BZ plus **A4 / HCR, non-cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

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	$N_{Rk,p,red}$	[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 $h_{min} < h < h_{std}$ (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	1)	1)
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	1)	1)		
Spacing (edge distance)	$s_{cr,sp}$ (= 2 $c_{cr,sp}$)	[mm]	200	200	250	300		
Increasing factor for $N_{Rk,p(red)}$ 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 for non-cracked concrete	k_{ucr}	[-]	10,1					

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

Table C5: Characteristic values for **shear loads**, BZ plus, **cracked** and **non-cracked concrete,** static or quasi static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

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										
k factor		$k_{(3)}$	[-]	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	40	50	65			
	Stainless steel A4, HCR	$l_{f,red}$	[mm]	35	40	50	65			
Outside diameter of anchor		d_{nom}	[mm]	8	10	12	16	20	24	27

Wedge Anchor BZ plus

Performance
Characteristic values for **shear loads**, BZ plus, **cracked** and **non-cracked concrete,** static or quasi static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

Annex C5

Table C6: Characteristic resistance for **seismic loading**, BZ plus, **standard anchorage depth,** performance category **C1** and **C2,** design according to TR045

Tension loads						
Anchor size			**M10**	**M12**	**M16**	**M20**
Installation safety factor	$\gamma_2 = \gamma_{inst}$	[-]	1,0			
Steel failure, steel zinc plated						
Characteristic resistance **C1**	$N_{Rk,s,seis,C1}$	[kN]	27	40	60	86
Characteristic resistance **C2**	$N_{Rk,s,seis,C2}$	[kN]	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]	27	40	64	108
Characteristic resistance **C2**	$N_{Rk,s,seis,C2}$	[kN]	27	40	64	108
Partial safety factor	$\gamma_{Ms,seis}$	[-]	1,5			1,68
Pull-out						
Characteristic resistance **C1**	$N_{Rk,p,seis,C1}$	[kN]	9	16	25	36
Characteristic resistance **C2**	$N_{Rk,p,seis,C2}$	[kN]	3,6	10,2	13,8	22,4

Shear loads						
Steel failure without lever arm, Steel zinc plated						
Characteristic resistance **C1**	$V_{Rk,s,seis,C1}$	[kN]	20	27	44	69
Characteristic resistance **C2**	$V_{Rk,s,seis,C2}$	[kN]	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]	20	27	44	69
Characteristic resistance **C2**	$V_{Rk,s,seis,C2}$	[kN]	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, design acc. to TR 020 or CEN/TS 1992-4, Annex D

Anchor size				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**
Tension load										
Steel failure										
Steel zinc plated										
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	1,4	2,2	3,2	6,0	9,4	13,6	17,6
	R60			1,1	1,8	2,8	5,2	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	11,5	21,5	33,5	48,2	
	R60			2,9	5,2	8,6	16	25,0	35,9	
	R90			2,0	3,5	5,6	10,5	16,4	23,6	
	R120			1,6	2,7	4,2	7,8	12,1	17,4	
Shear load										
Steel failure without lever arm										
Steel zinc plated										
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	1,6	2,6	3,8	7,0	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	11,5	21,5	33,5	48,2	
	R60			2,9	5,2	8,6	16	25,0	35,9	
	R90			2,0	3,5	5,6	10,5	16,4	23,6	
	R120			1,6	2,7	4,2	7,8	12,1	17,4	
Steel failure with lever arm										
Steel zinc plated										
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	1,7	3,3	5,9	15	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	17,9	45,5	88,8	153,5	
	R60			2,9	6,8	13,3	33,9	66,1	114,3	
	R90			2,1	4,5	8,8	22,2	43,4	75,1	
	R120			1,6	3,4	6,5	16,4	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 $N_{Rk,p}$ in Eq. 2.4 and Eq. 2.5, TR 020 must be replaced by $N^0_{Rk,c}$.

Table C8: 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]		4,1	4,9	3,6	5,1		
Displacements for ULS	$\delta_{N,seis,C2(ULS)}$	[mm]		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]		4,1	4,9	3,6	5,1		
Displacements for ULS	$\delta_{N,seis,C2(ULS)}$	[mm]		13,8	15,7	9,5	15,2		
Reduced anchorage depth									
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 C9: 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]		2,7	3,5	4,3	4,7		
Displacements for ULS	$\delta_{V,seis,C2(ULS)}$	[mm]		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]		2,7	3,5	4,3	4,7		
Displacements for ULS	$\delta_{V,seis,C2(ULS)}$	[mm]		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 C10: Characteristic values for **tension loads, BZ-IG, cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

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 for cracked concrete	k_{cr}	[-]	7,2			

Table C11: Characteristic values for **tension loads, BZ-IG, non-cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

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 for non-cracked concrete	k_{ucr}	[-]	10,1			

Table C12: Characteristic values for **shear loads, BZ-IG, cracked and non-cracked concrete,** static and quasi-static action, design method A according to ETAG 001, Annex C or CEN/TS 1992-4

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						
k factor	$k_{(3)}$	[-]	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 C13: Characteristic values for **tension** and **shear load** under **fire exposure, BZ-IG**
cracked and non-cracked concrete C20/25 to C50/60,
design acc. to TR 020 or CEN/TS 1992-4, Annex D

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 C14: 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 C15: 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