BUILDING TRUST

Sika AnchorFix®- 2+

DECLARATION DE PERFORMANCES

No. 75735322

1	**CODE D'IDENTIFICATION UNIQUE DU PRODUIT TYPE:**	75735322
2	**USAGES PRÉVUS:**	ETA 14/0346 Scellement chimique de tiges filetées et de barres d'armatures pour utilisation dans du béton fissuré et non fissuré.
3	**FABRICANT:**	Sika France S.A.S. 84, rue Edouard Vaillant 93350 Le Bourget
4	**MANDATAIRE:**	
5	**SYSTEME(S) D'EVALUATION ET DE VERIFICATION DE LA CONSTANCE DES PERFORMANCES:**	Système 1
6b	**DOCUMENT D'ÉVALUATION EUROPÉEN:**	ETAG 001-Partie 1 et Partie 5, édition 2013
	Agrément Technique Européen:	ETA 14/0346
	Organisme d'Evaluation Technique:	**Technical and Test Institute for Construction Prague** Prosecká 811/76a 190 00 Prague Czech Republic
	Organisme notifié:	1020

7 PERFORMANCES DECLAREES

Réaction au feu – Scellements satisfaisant les exigences de la Classe A1.
Résistance au feu - Performance non évaluée.

Scellements soumis au(x):
- Charges statiques et quasi-statiques.
- Performances sismiques de catégorie C1 : tiges filetées M10, M12, M16, M20, M24.

Supports :
- Béton non fissuré.
- Béton fissuré et non fissuré pour les tiges filetées M10, M12, M16, M20, M24.
- Béton armé ou non armé, non allégé, de classe de résistance minimale C20/25 et maximale C50/60 selon EN 206-1:2000-12.

Plage de température :
- De -40°C à +80°C (température maximale à court terme +80°C et température maximale à long terme +50°C).

Conditions d'utilisation (conditions environnementales)
- Structures soumises à des ambiances intérieures sèches (acier galvanisé, acier inoxydable, acier à haute résistance à la corrosion).
- Structures soumises à des exposions atmosphériques extérieures incluant l'environnement industriel et marin, sous réserve qu'il n'existe pas de conditions agressives particulières (acier inoxydable, acier à haute résistance à la corrosion).
- Structures soumises à des conditions permanentes d'humidité interne, sous réserve qu'il n'existe pas de conditions agressives particulières (acier inoxydable, acier à haute résistance à la corrosion).
- Structures soumises à des conditions permanentes d'humidité interne, avec des conditions agressives particulières (acier à haute résistance à la corrosion).

Note : Les conditions agressives particulières sont, par exemple, l'immersion alternée dans l'eau de mer ou les zones d'éclaboussures d'eau de mer, l'ambiance chlorée des piscines intérieures ou l'ambiance avec une pollution chimique extrême (par exemple des installations/usines de désulfuration ou dans des tunnels routiers où des produits de déverglaçage sont utilisés).

Catégories d'utilisation :
- Catégorie 2 – installation dans du béton sec ou humide ou un trou rempli d'eau.

Calcul :
- Les ancrages sont calculés conformément à l'EOTA Technical Report TR 029 "Design of bonded anchors" sous la responsabilité d'un ingénieur expérimenté pour les travaux d'ancrage.
- Les notes de calculs et les plans à vérifier sont préparés en tenant compte des charges à reprendre par ancrage. La position des ancrages est indiquée sur les plans. Les ancrages sous actions sismiques (béton fissuré) doivent être calculés conformément à l'EOTA Technical Report TR 045 "Design of Metal Anchors under Seismic Action).

Installation :

- Béton sec ou humide ou trou inondé.
- Perçage du trou par un foret rotatif.
- L'installation des ancrages est réalisée par un personnel qualifié et sous la supervision de la personne responsable des aspects techniques du site.

Table B1: Installation parameters of threaded rod

Size			M8	M10	M12	M16	M20	M24	M27	M30
Nominal drill hole diameter	$Ød_0$	[mm]	10	12	14	18	22	26	30	35
Diameter of cleaning brush	d_b	[mm]	14	14	20	20	29	29	40	40
Torque moment	T_{inst}	[Nm]	10	20	40	80	150	200	240	275
$h_{ef,min}$ = 8d										
Depth of drill hole	h_0	[mm]	64	80	96	128	160	192	216	240
Minimum edge distance	c_{min}	[mm]	35	40	50	65	80	96	110	120
Minimum spacing	s_{min}	[mm]	35	40	50	65	80	96	110	120
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + 2d_0			
$h_{ef,max}$ = 20d										
Depth of drill hole	h_0	[mm]	160	200	240	320	400	480	540	600
Minimum edge distance	c_{min}	[mm]	80	100	120	160	200	240	270	300
Minimum spacing	s_{min}	[mm]	80	100	120	160	200	240	270	300
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + 2d_0			

Table B2: Installation parameters of rebar

Size			Ø8	Ø10	Ø12	Ø16	Ø20	Ø25	Ø32
Nominal drill hole diameter	$Ød_0$	[mm]	12	14	16	20	25	32	40
Diameter of cleaning brush	d_b	[mm]	14	14	19	22	29	40	42
$h_{ef,min}$ = 8d									
Depth of drill hole	h_0	[mm]	64	80	96	128	160	200	256
Minimum edge distance	c_{min}	[mm]	35	40	50	65	80	100	130
Minimum spacing	s_{min}	[mm]	35	40	50	65	80	100	130
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + 2d_0		
$h_{ef,max}$ = 20d									
Depth of drill hole	h_0	[mm]	160	200	240	320	400	500	640
Minimum edge distance	c_{min}	[mm]	80	100	120	160	200	250	320
Minimum spacing	s_{min}	[mm]	80	100	120	160	200	250	320
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + 2d_0		

Table B3: Cleaning

All diameters
- 2 x blowing
- 2 x brushing
- 2 x blowing
- 2 x brushing
- 2 x blowing

Table B4: Minimum curing time

Sika AnchorFix® -2 Normal		
Application temperature	**Processing time**	**Load time**
+5 to +10°C	10 mins	145 mins
+10 to +15°C	8 mins	85 mins
+15 to +20°C	6 mins	75 mins
+20 to +25°C	5 mins	50 mins
+25 to +30°C	4 mins	40 mins

Processing time refers to the highest temperature in the range.
Load time refers to the lowest temperature in the range.
Cartridge must be conditioned to a minimum +5°C.

Table C1: Design method TR 029
Characteristic values of resistance to tension load of threaded rod

Steel failure – Characteristic resistance										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$N_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} 1)	[-]	2							
Steel grade **5.8**	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} 1)	[-]	1,5							
Steel grade **8.8**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} 1)	[-]	1,5							
Steel grade **10.9**	$N_{Rk,s}$	[kN]	37	58	84	157	245	353	459	561
Partial safety factor	γ_{Ms} 1)	[-]	1,4							
Stainless steel grade **A4-70**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} 1)	[-]	1,9							
Stainless steel grade **A4-80**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} 1)	[-]	1,6							
Stainless steel grade **1.4529**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} 1)	[-]	1,5							

Combined pullout and concrete cone failure in non-cracked concrete C20/25									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Characteristic bond resistance in non-cracked concrete										
Dry and wet concrete	τ_{Rk}	[N/mm^2]	11	10	9,5	9	8,5	8	6,5	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]						2,1 [3)]	
Flooded hole	τ_{Rk}	[N/mm^2]	9	8	7,5	7	7	6		
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]							
Factor for concrete C50/60	ψ_c	[-]	1							

Combined pullout and concrete cone failure in cracked concrete C20/25							
Size			**M10**	**M12**	**M16**	**M20**	**M24**
Characteristic bond resistance in cracked concrete							
Dry and wet concrete	τ_{Rk}	[N/mm^2]	5	5	5	4,5	4,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]				
Flooded hole	τ_{Rk}	[N/mm^2]	5	5	5	4,5	4,5
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]				
Factor for cracked concrete C30/37	ψ_c	[-]	1,12				
Factor for cracked concrete C40/50	ψ_c	[-]	1,23				
Factor for cracked concrete C50/60	ψ_c	[-]	1,30				

Splitting failure									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Edge distance	$c_{cr,sp}$	[mm]	$1{,}5h_{ef}$							
Spacing	$s_{cr,sp}$	[mm]	$3{,}0h_{ef}$							
Partial safety factor	γ_{Ms} [1)]	[-]	1,8							

[1)] In absence of national regulations

[2)] The partial safety factor γ_2=1,2 is included

[3)] The partial safety factor γ_2=1,4 is included

Table C2: Design method TR 029

Characteristic values of resistance to tension load of rebar

Steel failure – Characteristic resistance								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$N_{Rk,s}$	[kN]	28	43	62	111	173	270	442
Partial safety factor [1]	γ_{Ms}	[-]	1,4						

Combined pullout and concrete cone failure in non-cracked concrete C20/25									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Characteristic bond resistance in non-cracked concrete									
Dry and wet concrete	τ_{Rk}	[N/mm²]	12	10	10	9	9	9	5,5
Partial safety factor [1]	γ_{Mc}	[-]	1,8 [2]						
Flooded hole	τ_{Rk}	[N/mm²]	12	10	10	9	9	9	5,5
Partial safety factor [1]	γ_{Mc}	[-]	2,1 [3]						
Factor for concrete C50/60	ψ_c	[-]	1						

Splitting failure									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Edge distance	$c_{cr,sp}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,sp}$	[mm]	$3,0h_{ef}$						
Partial safety factor [1]	γ_{Msp}	[-]	1,8						

[1] In absence of national regulations

[2] The partial safety factor γ_2=1,2 is included

[3] The partial safety factor γ_2=1,4 is included

Table C3: Design method TR 029
Characteristic values of resistance to shear load of threaded rod

Steel failure without lever arm									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$V_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Partial safety factor	γ_{Ms} [1)]	[-]	1,67							
Steel grade **5.8**	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **8.8**	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **10.9**	$V_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Stainless steel grade **A4-70**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Stainless steel grade **A4-80**	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **1.4529**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							

Steel failure with lever arm									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$M^0_{Rk,s}$	[N.m]	15	30	52	133	260	449	666	900
Partial safety factor	γ_{Ms} [1)]	[-]	1,67							
Steel grade **5.8**	$M^0_{Rk,s}$	[N.m]	19	37	66	166	325	561	832	1125
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **8.8**	$M^0_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **10.9**	$M^0_{Rk,s}$	[N.m]	37	75	131	333	649	1123	1664	2249
Partial safety factor	γ_{Ms} [1)]	[-]	1,50							
Stainless steel grade **A4-70**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Stainless steel grade **A4-80**	$M^0_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **1.4529**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Concrete pryout failure										
Factor *k* from TR 029 Design of bonded anchors, Part 5.2.3.3			2							
Partial safety factor	γ_{Mp} [1)]	[-]	1,5							

Concrete edge failure									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
See section 5.2.3.4 of Technical Report TR 029 for the Design of Bonded Anchors									
Partial safety factor	γ_{Mc} [1)]	[-]	1,5						

[1)] In absence of national regulations

Table C4: Design method TR 029
Characteristic values of resistance to shear load of rebar

Steel failure without lever arm								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$V_{Rk,s}$	[kN]	14	22	31	55	86	135	221
Partial safety factor	γ_{Ms} [1)]	[-]	1,5						

Steel failure with lever arm								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$M^0_{Rk,s}$	[N.m]	33	65	112	265	518	1013	2122
Partial safety factor	γ_{Ms} [1)]	[-]	1,5						
Concrete pryout failure									
Factor *k* from TR 029 Design of bonded anchors, Part 5.2.3.3			2						
Partial safety factor	γ_{Mp} [1)]	[-]	1,5						

Concrete edge failure								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
See section 5.2.3.4 of Technical Report TR 029 for the Design of Bonded Anchors									
Partial safety factor	γ_{Mc} [1)]	[-]	1,5						

[1)] In absence of national regulations

Table C5: Design method CEN/TS 1992-4
Characteristic values of resistance to tension load of threaded rod

Steel failure – Characteristic resistance										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$N_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	2							
Steel grade **5.8**	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Steel grade **8.8**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Steel grade **10.9**	$N_{Rk,s}$	[kN]	37	58	84	157	245	353	459	561
Partial safety factor	γ_{Ms} [1)]	[-]	1,4							
Stainless steel grade **A4-70**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,9							
Stainless steel grade **A4-80**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,6							
Stainless steel grade **1.4529**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							

Combined pullout and concrete cone failure in non-cracked concrete C20/25										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Characteristic bond resistance in non-cracked concrete										
Dry and wet concrete	τ_{Rk}	[N/mm²]	11	10	9,5	9	8,5	8	6,5	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]						2,1 [3)]	
Flooded hole	τ_{Rk}	[N/mm²]	9	8	7,5	7	7	6		
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]							
Factor for concrete C50/60	ψ_c	[-]	1							
Factor according to CEN/TS 1992-4-5Section 6.2.2		k_8	10,1							

Combined pullout and concrete cone failure in cracked concrete C20/25							
Size			**M10**	**M12**	**M16**	**M20**	**M24**
Characteristic bond resistance in cracked concrete							
Dry and wet concrete	τ_{Rk}	[N/mm²]	5	5	5	4,5	4,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]				
Flooded hole	τ_{Rk}	[N/mm²]	5	5	5	4,5	4,5
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]				
Factor for cracked concrete C30/37	ψ_c	[-]	1,12				
Factor for cracked concrete C40/50	ψ_c	[-]	1,23				
Factor for cracked concrete C50/60	ψ_c	[-]	1,30				
Factor according to CEN/TS 1992-4-5 Section 6.2.2		k_8	7,2				

Concrete cone failure									
Size			M8	M10	M12	M16	M20	M24	M27	M30
Factor according to CEN/TS 1992-4-5 Section 6.2.3	k_{ucr}		10,1						
	k_{cr}			7,2					
Edge distance	$c_{cr,N}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,N}$	[mm]	$3,0h_{ef}$						
Splitting failure									
Edge distance	$c_{cr,sp}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,sp}$	[mm]	$3,0h_{ef}$						
Partial safety factor	γ_{Ms} [1)] p	[-]	1,8						

[1)] In absence of national regulations

[2)] The partial safety factor γ_2=1,2 is included

[3)] The partial safety factor γ_2=1,4 is included

Table C6: Design method CEN/TS 1992-4

Characteristic values of resistance to tension load of rebar

Steel failure – Characteristic resistance									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$N_{Rk,s}$	[kN]	28	43	62	111	173	270	442
Partial safety factor	γ_{Ms} [1)]	[-]	1,4						

Combined pullout and concrete cone failure in non-cracked concrete C20/25									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Characteristic bond resistance in non-cracked concrete									
Dry and wet concrete	τ_{Rk}	[N/mm²]	12	10	10	9	9	9	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]						
Flooded hole	τ_{Rk}	[N/mm²]	12	10	10	9	9	9	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]						
Factor for concrete C50/60	ψ_c	[-]	1						
Factor according to CEN/TS 1992-4-5Section 6.2.2	k_8		10,1						

Concrete cone failure								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Factor according to CEN/TS 1992-4-5 Section 6.2.3	k_{ucr}		10,1						
Edge distance	$c_{cr,N}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,N}$	[mm]	$3,0h_{ef}$						
Splitting failure									
Edge distance	$c_{cr,sp}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,sp}$	[mm]	$3,0h_{ef}$						
Partial safety factor	γ_{Ms} [1)]	[-]	1,8						

[1)] In absence of national regulations

[2)] The partial safety factor γ_2=1,2 is included

[3)] The partial safety factor γ_2=1,4 is included

Table C7: Design method CEN/TS 1992-4
Characteristic values of resistance to shear load of threaded rod

Steel failure without lever arm									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$V_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Partial safety factor	γ_{Ms} [1)]	[-]	1,67							
Steel grade **5.8**	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **8.8**	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **10.9**	$V_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Stainless steel grade **A4-70**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Stainless steel grade **A4-80**	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **1.4529**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Ductility factor according to CEN/TS 1992-4-5 Section 6.3.2.1		k_2	0,8							

Steel failure with lever arm									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$M^0_{Rk,s}$	[N.m]	15	30	52	133	260	449	666	900
Partial safety factor	γ_{Ms}	[-]	1,67							
Steel grade **5.8**	$M^0_{Rk,s}$	[N.m]	19	37	66	166	325	561	832	1125
Partial safety factor	γ_{Ms}	[-]	1,25							
Steel grade **8.8**	$M^0_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms}	[-]	1,25							
Steel grade **10.9**	$M^0_{Rk,s}$	[N.m]	37	75	131	333	649	1123	1664	2249
Partial safety factor	γ_{Ms}	[-]	1,50							
Stainless steel grade **A4-70**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms}	[-]	1,56							
Stainless steel grade **A4-80**	$M^0_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms}	[-]	1,33							
Stainless steel grade **1.4529**	M^0	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms}	[-]	1,25							
Concrete pryout failure										
Factor according to CEN/TS 1992-4-5 Section 6.3.3		k_3	2,0							
Partial safety factor	γ_M	[-]	1,5							

Concrete edge failure									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
See section 6.3.4 of CEN/TS 1992-4-5									
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	30
Partial safety factor	γ_{Mc} [1)]	[-]	1,5						

[1)] In absence of national regulations

Table C8: Design method CEN/TS 1992-4
Characteristic values of resistance to shear load of rebar

Steel failure without lever arm								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$V_{Rk,s}$	[kN]	14	22	31	55	86	135	221
Partial safety factor	γ_{Ms} [1)]	[-]	1,5						
Ductility factor according to CEN/TS 1992-4-5 Section 6.3.2.1 k2	K_2		0,8						

Steel failure with lever arm								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$M^0_{Rk,s}$	[N.m]	33	65	112	265	518	1013	2122
Partial safety factor	γ_{Ms} [1)]	[-]	1,5						
Concrete pryout failure								
Factor according to CEN/TS 1992-4-5 Section 6.3.3 k3	K_3		2,0						
Partial safety factor	γ_{Mp} [1)]	[-]	1,5						

Concrete edge failure								
Size		**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
See section 6.3.4 of CEN/TS 1992-4-5								
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	30
Partial safety factor	γ_{Mc} [1)] [-]	1,5						

1) In absence of national regulations

Table C9: Displacement of threaded rod under tension and shear load

Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non-cracked concrete										
Tension load	F	[kN]	6,3	7,9	11,9	15,9	23,8	29,8	37,7	45,6
Displacement	δ_{N0}	[mm]	0,3	0,3	0,3	0,3	0,4	0,5	0,5	0,5
	$\delta_{N\infty}$	[mm]	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
Shear load	F	[kN]	3,1	5,0	7,2	13,5	21,0	30,3	39,4	48,0
Displacement	δ_{V0}	[mm]	1,5	1,5	1,5	1,5	2,0	2,5	2,5	2,5
	$\delta_{V\infty}$	[mm]	2,3	2,3	2,3	2,3	3,0	3,8	3,8	3,8
Cracked concrete										
Tension load	F	[kN]		5,1	7,4	13,1	20,5	24,6		
Displacement	δ_{N0}	[mm]		0,4	0,7	0,7	0,7	0,6		

Table C10: Displacement of rebar under tension and shear load

Rebar size			Ø8	Ø10	Ø12	Ø16	Ø20	Ø25	Ø32
Non-cracked concrete									
Tension load	F	[kN]	7,9	9,9	13,9	23,8	29,8	55,6	55,6
Displacement	δ_{N0}	[mm]	0,3	0,3	0,3	0,4	0,4	0,5	0,5
	$\delta_{N\infty}$	[mm]	0,5	0,5	0,5	0,5	0,5	0,5	0,5
Shear load	F	[kN]	5,9	9,3	13,3	23,7	37,0	57,9	94,8
Displacement	δ_{V0}	[mm]	0,3	0,4	0,4	0,4	0,4	0,5	0,9
	$\delta_{V\infty}$	[mm]	0,5	0,6	0,6	0,6	0,6	0,8	1,4

Table C11: Characteristic values of resistance under seismic action category C1 for threaded rods

Size			M10	M12	M16	M20	M24
Tension load							
Steel failure							
Characteristic resistance grade **4.6**	$N_{Rk,s,seis}$	[kN]	23	34	63	98	141
Partial safety factor	γ_{Ms} [1)]	[-]			2,00		
Characteristic resistance grade **5.8**	$N_{Rk,s,seis}$	[kN]	29	42	79	123	177
Partial safety factor	γ_{Ms} [1)]	[-]			1,50		
Characteristic resistance grade **8.8**	$N_{Rk,s,seis}$	[kN]	46	67	126	196	282
Partial safety factor	γ_{Ms} [1)]	[-]			1,50		
Characteristic resistance grade **10.9**	$N_{Rk,s,seis}$	[kN]	58	84	157	245	353
Partial safety factor	γ_{Ms} [1)]	[-]			1,33		
Characteristic resistance **A2-70, A4-70**	$N_{Rk,s,seis}$	[kN]	41	59	110	172	247
Partial safety factor	γ_{Ms} [1)]	[-]			1,87		
Characteristic resistance **A4-80**	$N_{Rk,s,seis}$	[kN]	46	67	126	196	282
Partial safety factor	γ_{Ms} [1)]	[-]			1,60		
Characteristic resistance **1.4529**	$N_{Rk,s,seis}$	[kN]	41	59	110	172	247
Partial safety factor	γ_{Ms} [1)]	[-]			1,50		
Characteristic resistance **1.4565**	$N_{Rk,s,seis}$	[kN]	41	59	110	172	247
Partial safety factor	γ_{Ms} [1)]	[-]			1,87		
Combined pull-out and concrete cone failure							
Dry and wet concrete	$\tau_{Rk,seis,C1}$	[N/mm²]	3,9	3,9	3,9	3,9	3,9
Partial safety factor	γ_{Mc} [1)]	[-]			1,8 [2)]		
Flooded hole	$\tau_{Rk,seis,C1}$	[N/mm²]	3,9	3,9	3,9	3,9	3,9
Partial safety factor	γ_{Mc} [1)]	[-]			2,1 [3)]		

Shear load							
Steel failure without lever arm							
Characteristic resistance grade **4.6**	$V_{Rk,s,seis}$	[kN]	7	10	23	30	40
Partial safety factor	γ_{Ms} [1)]	[-]			1,67		
Characteristic resistance grade **5.8**	$V_{Rk,s,seis}$	[kN]	9	13	28	38	51
Partial safety factor	γ_{Ms} [1)]	[-]			1,25		
Characteristic resistance grade **8.8**	$V_{Rk,s,seis}$	[kN]	14	21	45	61	81
Partial safety factor	γ_{Ms} [1)]	[-]			1,25		
Characteristic resistance grade **10.9**	$V_{Rk,s,seis}$	[kN]	18	26	56	76	101
Partial safety factor	γ_{Ms} [1)]	[-]			1,50		
Characteristic resistance **A2-70**, **A4-70**	$V_{Rk,s,seis}$	[kN]	12	18	39	53	71
Partial safety factor	γ_{Ms} [1)]	[-]			1,56		
Characteristic resistance **A4-80**	$V_{Rk,s,seis}$	[kN]	14	21	45	61	81
Partial safety factor	γ_{Ms} [1)]	[-]			1,33		
Characteristic resistance **1.4529**	$V_{Rk,s,seis}$	[kN]	12	18	39	53	71
Partial safety factor	γ_{Ms} [1)]	[-]			1,25		
Characteristic resistance **1.4565**	$V_{Rk,s,seis}$	[kN]	12	18	39	53	71
Partial safety factor	γ_{Ms} [1)]	[-]			1,56		

[1)] In absence of national regulations
[2)] The partial safety factor γ_2=1,2 is included
[3)] The partial safety factor γ_2=1,4 is included

Note: Rebars are not qualified for seismic design

8 DOCUMENTATION TECHNIQUE APPROPRIEE ET/OU DOCUMENTATION TECHNIQUE SPECIFIQUE

Les performances du produit identifié ci-dessus sont conformes aux performances déclarées. Conformément au règlement (UE) no 305/2011, la présente déclaration des performances est établie sous la seule responsabilité du fabricant mentionné ci-dessus.

Signé pour le fabricant et en son nom par:

Name : GICQUEL YVON
Fonction: Chef Produits
Date et lieu : Le Bourget, le 12.03.2018

Nom : Frédéric Girard
Fonction: Directeur Général Adjoint
Date et lieu : Le Bourget, le 12.03.2018

Fin des informations requises par le règlement (EU) No 305/2011

Cette Déclaration de Performances, peut être téléchargée sur le site : www.sika-dop.fr

Autre DECLARATION de PERFORMANCES relative au Sika AnchroFix-2+

Nom Produit	Evaluation Technique Européenne (ETE)	N° DoP
Sika AnchorFix-2+ scellement d'armatures rapportées	ETA-13/0779	88587701

CE

14

Sika France SAS, Le Bourget, France

DoP No. 75735322

ETAG 001, Part 1 “Anchors in general”, Part 5 “Bonded anchors”

Organisme Notifié 1020

Scellement chimique de tiges filetées et de barres d’armatures pour utilisation dans du béton fissuré et non fissuré.

Réaction au feu – Scellements satisfaisant les exigences de la Classe A1.
Résistance au feu - Performance non évaluée.

Scellements soumis au(x):

- Charges statiques et quasi-statiques.
- Performances sismiques de catégorie C1 : tiges filetées M10, M12, M16, M20, M24.

Supports :

- Béton non fissuré.
- Béton fissuré et non fissuré pour les tiges filetées M10, M12, M16, M20, M24.
- Béton armé ou non armé, non allégé, de classe de résistance minimale C20/25 et maximale C50/60 selon EN 206-1:2000-12.

Plage de température :

- De -40°C à +80°C (température maximale à court terme +80°C et température maximale à long terme +50°C.

Conditions d’utilisation (conditions environnementales)

- Structures soumises à des ambiances intérieures sèches (acier galvanisé, acier inoxydable, acier à haute résistance à la corrosion).
- Structures soumises à des exposions atmosphériques extérieures incluant l’environnement industriel et marin, sous réserve qu’il n’existe pas de conditions agressives particulières (acier inoxydables, acier à haute résistance à la corrosion).
- Structures soumises à des conditions permanentes d’humidité interne, sous réserve qu’il n’existe pas de conditions agressives particulières (acier inoxydables, acier à haute résistance à la corrosion).
- Structures soumises à des conditions permanentes d’humidité interne, avec des conditions agressives particulières (acier à haute résistance à la corrosion.

Note : Les conditions agressives particulières sont, par exemple, l’immersion alternée dans l’eau de mer ou les zones d’éclaboussures d’eau de mer, l’ambiance chlorée des piscines intérieures ou l’ambiance avec une pollution chimique extrême (par exemple des installations/usines de désulfuration ou dans des tunnels routiers où des produits de déverglaçage sont utilisés).

Catégories d’utilisation :

- Catégorie 2 – installation dans du béton sec ou humide ou un trou rempli d’eau.

Calcul :

- Les ancrages sont calculés conformément à l’EOTA Technical Report TR 029 “Design of bonded anchors” sous la responsabilité d’un ingénieur expérimenté pour les travaux d’ancrage.
- Les notes de calculs et les plans à vérifier sont préparés en tenant compte des charges à reprendre par

ancrage. La position des ancrages est indiquée sur les plans. Les ancrages sous actions sismiques (béton fissuré) doivent être calculés conformément à l'EOTA Technical Report TR 045 "Design of Metal Anchors under Seismic Action).

Installation :

- Béton sec ou humide ou trou inondé.
- Perçage du trou par un foret rotatif.
- L'installation des ancrages est réalisée par un personnel qualifié et sous la supervision de la personne responsable des aspects techniques du site.

Table B1: Installation parameters of threaded rod

Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Nominal drill hole diameter	$Ød_0$	[mm]	10	12	14	18	22	26	30	35
Diameter of cleaning brush	d_b	[mm]	14	14	20	20	29	29	40	40
Torque moment	T_{inst}	[Nm]	10	20	40	80	150	200	240	275
$h_{ef,min}$ = 8d										
Depth of drill hole	h_0	[mm]	64	80	96	128	160	192	216	240
Minimum edge distance	c_{min}	[mm]	35	40	50	65	80	96	110	120
Minimum spacing	s_{min}	[mm]	35	40	50	65	80	96	110	120
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + $2d_0$			
$h_{ef,max}$ = 20d										
Depth of drill hole	h_0	[mm]	160	200	240	320	400	480	540	600
Minimum edge distance	c_{min}	[mm]	80	100	120	160	200	240	270	300
Minimum spacing	s_{min}	[mm]	80	100	120	160	200	240	270	300
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + $2d_0$			

Table B2: Installation parameters of rebar

Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Nominal drill hole diameter	$Ød_0$	[mm]	12	14	16	20	25	32	40
Diameter of cleaning brush	d_b	[mm]	14	14	19	22	29	40	42
$h_{ef,min}$ = 8d									
Depth of drill hole	h_0	[mm]	64	80	96	128	160	200	256
Minimum edge distance	c_{min}	[mm]	35	40	50	65	80	100	130
Minimum spacing	s_{min}	[mm]	35	40	50	65	80	100	130
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + $2d_0$		
$h_{ef,max}$ = 20d									
Depth of drill hole	h_0	[mm]	160	200	240	320	400	500	640
Minimum edge distance	c_{min}	[mm]	80	100	120	160	200	250	320
Minimum spacing	s_{min}	[mm]	80	100	120	160	200	250	320
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm				h_{ef} + $2d_0$		

Table B3: Cleaning

All diameters
- 2 x blowing
- 2 x brushing
- 2 x blowing
- 2 x brushing
- 2 x blowing

Table B4: Minimum curing time

Sika AnchorFix® -2 Normal		
Application temperature	**Processing time**	**Load time**
+5 to +10°C	10 mins	145 mins
+10 to +15°C	8 mins	85 mins
+15 to +20°C	6 mins	75 mins
+20 to +25°C	5 mins	50 mins
+25 to +30°C	4 mins	40 mins

Processing time refers to the highest temperature in the range.
Load time refers to the lowest temperature in the range.
Cartridge must be conditioned to a minimum +5°C.

Table C1: Design method TR 029

Characteristic values of resistance to tension load of threaded rod

Steel failure – Characteristic resistance										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$N_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	2							
Steel grade **5.8**	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Steel grade **8.8**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Steel grade **10.9**	$N_{Rk,s}$	[kN]	37	58	84	157	245	353	459	561
Partial safety factor	γ_{Ms} [1)]	[-]	1,4							
Stainless steel grade **A4-70**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,9							
Stainless steel grade **A4-80**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,6							
Stainless steel grade **1.4529**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							

Combined pullout and concrete cone failure in non-cracked concrete C20/25									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Characteristic bond resistance in non-cracked concrete										
Dry and wet concrete	τ_{Rk}	[N/mm²]	11	10	9,5	9	8,5	8	6,5	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]						2,1 [3)]	
Flooded hole	τ_{Rk}	[N/mm²]	9	8	7,5	7	7	6		
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]							
Factor for concrete C50/60	ψ_c	[-]	1							

Splitting failure									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Edge distance	$c_{cr,sp}$	[mm]	$1,5h_{ef}$							
Spacing	$s_{cr,sp}$	[mm]	$3,0h_{ef}$							
Partial safety factor	γ_{Ms} [1)]	[-]	1,8							

[1)] In absence of national regulations

[2)] The partial safety factor γ_2=1,2 is included

[3] The partial safety factor γ_2=1,4 is included

Table C2: Design method TR 029
Characteristic values of resistance to tension load of rebar

Steel failure – Characteristic resistance								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$N_{Rk,s}$	[kN]	28	43	62	111	173	270	442
Partial safety factor	[1] γ_{Ms}	[-]	1,4						

Combined pullout and concrete cone failure in non-cracked concrete C20/25								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Characteristic bond resistance in non-cracked concrete								
Dry and wet concrete	τ_{Rk}	[N/mm²]	12	10	10	9	9	9	5,5
Partial safety factor	[1] γ_{Mc}	[-]	1,8[2]						
Flooded hole	τ_{Rk}	[N/mm²]	12	10	10	9	9	9	5,5
Partial safety factor	[1] γ_{Mc}	[-]	2,1[3]						
Factor for concrete C50/60	ψ_c	[-]	1						

Splitting failure								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Edge distance	$c_{cr,sp}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,sp}$	[mm]	$3,0h_{ef}$						
Partial safety factor	[1] γ_{Msp}	[-]	1,8						

[1] In absence of national regulations
[2] The partial safety factor γ_2=1,2 is included
[3] The partial safety factor γ_2=1,4 is included

Table C3: Design method TR 029
Characteristic values of resistance to shear load of threaded rod

Steel failure without lever arm

Size			M8	M10	M12	M16	M20	M24	M27	M30
Steel grade **4.6**	$V_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Partial safety factor	γ_{Ms} 1)	[-]	1,67							
Steel grade **5.8**	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Partial safety factor	γ_{Ms} 1)	[-]	1,25							
Steel grade **8.8**	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} 1)	[-]	1,25							
Steel grade **10.9**	$V_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} 1)	[-]	1,5							
Stainless steel grade **A4-70**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} 1)	[-]	1,56							
Stainless steel grade **A4-80**	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} 1)	[-]	1,33							
Stainless steel grade **1.4529**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} 1)	[-]	1,25							

Steel failure with lever arm										
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$M^0_{Rk,s}$	[N.m]	15	30	52	133	260	449	666	900

Partial safety factor	γ_{Ms} [1]	[-]	1,67						
Steel grade **5.8**	$M^o_{Rk,s}$	[N.m]	19	37	66	166	325	561	832	1125
Partial safety factor	γ_{Ms} [1]	[-]	1,25						
Steel grade **8.8**	$M^o_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms} [1]	[-]	1,25						
Steel grade **10.9**	$M^o_{Rk,s}$	[N.m]	37	75	131	333	649	1123	1664	2249
Partial safety factor	γ_{Ms} [1]	[-]	1,50						
Stainless steel grade **A4-70**	$M^o_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1]	[-]	1,56						
Stainless steel grade **A4-80**	$M^o_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms} [1]	[-]	1,33						
Stainless steel grade **1.4529**	$M^o_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1]	[-]	1,25						
Concrete pryout failure									
Factor *k* from TR 029 Design of bonded anchors, Part 5.2.3.3			2						
Partial safety factor	γ_{M} [1]	[-]	1,5						

Concrete edge failure									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
See section 5.2.3.4 of Technical Report TR 029 for the Design of Bonded Anchors									
Partial safety factor	γ_{Mc} [1]	[-]	1,5						

1) In absence of national regulations

Table C4: Design method TR 029
Characteristic values of resistance to shear load of rebar

Steel failure without lever arm									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$V_{Rk,s}$	[kN]	14	22	31	55	86	135	221
Partial safety factor	γ_{Ms} [1]	[-]	1,5						

Steel failure with lever arm									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$M^o_{Rk,s}$	[N.m]	33	65	112	265	518	1013	2122
Partial safety factor	γ_{Ms} [1]	[-]	1,5						
Concrete pryout failure									

Factor *k* from TR 029 Design of bonded anchors, Part 5.2.3.3			2
Partial safety factor	γ_{Mp} [1)]	[-]	1,5

Concrete edge failure								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
See section 5.2.3.4 of Technical Report TR 029 for the Design of Bonded Anchors									
Partial safety factor	γ_{Mc} [1)]	[-]	1,5						

1)
In absence of national regulations

Table C5: Design method CEN/TS 1992-4 - Characteristic values of resistance to tension load of threaded rod

Steel failure – Characteristic resistance									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$N_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	2							
Steel grade **5.8**	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Steel grade **8.8**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Steel grade **10.9**	$N_{Rk,s}$	[kN]	37	58	84	157	245	353	459	561
Partial safety factor	γ_{Ms} [1)]	[-]	1,4							
Stainless steel grade **A4-70**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,9							
Stainless steel grade **A4-80**	$N_{Rk,s}$	[kN]	29	46	67	126	196	282	367	449
Partial safety factor	γ_{Ms} [1)]	[-]	1,6							
Stainless steel grade **1.4529**	$N_{Rk,s}$	[kN]	26	41	59	110	172	247	321	393
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							

Combined pullout and concrete cone failure in non-cracked concrete C20/25									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Characteristic bond resistance in non-cracked concrete										
Dry and wet concrete	τ_{Rk}	[N/mm²]	11	10	9,5	9	8,5	8	6,5	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]						2,1 [3)]	
Flooded hole	τ_{Rk}	[N/mm²]	9	8	7,5	7	7	6		
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]							
Factor for concrete C50/60	ψ_c	[-]	1							
Factor according to CEN/TS 1992-4-5Section 6.2.2		k_8	10,1							

Combined pullout and concrete cone failure in cracked concrete C20/25							
Size			**M10**	**M12**	**M16**	**M20**	**M24**
Characteristic bond resistance in cracked concrete							
Dry and wet concrete	τ_{Rk}	[N/mm²]	5	5	5	4,5	4,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]				

Flooded hole	τ_{Rk}	[N/mm²]	5	5	5	4,5	4,5
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]				
Factor for cracked concrete C30/37	ψ_c	[-]	1,12				
Factor for cracked concrete C40/50	ψ_c	[-]	1,23				
Factor for cracked concrete C50/60	ψ_c	[-]	1,30				
Factor according to CEN/TS 1992-4-5 Section 6.2.2	k_8		7,2				

Concrete cone failure									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Factor according to CEN/TS 1992-4-5 Section 6.2.3	k_{ucr}		10,1						
	k_{cr}			7,2					
Edge distance	$c_{cr,N}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,N}$	[mm]	$3,0h_{ef}$						
Splitting failure									
Edge distance	$c_{cr,sp}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,sp}$	[mm]	$3,0h_{ef}$						
Partial safety factor	γ_{Ms} [1)]	[-]	1,8						

[1)] In absence of national regulations; [2)] The partial safety factor γ_2=1,2 is included, [3)] The partial safety factor γ_2=1,4 is included

Table C6: Design method CEN/TS 1992-4

Characteristic values of resistance to tension load of rebar

Steel failure – Characteristic resistance								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$N_{Rk,s}$	[kN]	28	43	62	111	173	270	442
Partial safety factor	γ_{Ms} [1)]	[-]	1,4						

Combined pullout and concrete cone failure in non-cracked concrete C20/25								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Characteristic bond resistance in non-cracked concrete									
Dry and wet concrete	τ_{Rk}	[N/mm²]	12	10	10	9	9	9	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]						
Flooded hole	τ_{Rk}	[N/mm²]	12	10	10	9	9	9	5,5
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]						
Factor for concrete C50/60	ψ_c	[-]	1						
Factor according to CEN/TS 1992-4-5Section 6.2.2	k_8		10,1						

Concrete cone failure								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Factor according to CEN/TS 1992-4-5 Section 6.2.3	k_{ucr}		10,1						
Edge distance	$c_{cr,N}$	[mm]	$1,5h_{ef}$						
Spacing	$s_{cr,N}$	[mm]	$3,0h_{ef}$						
Splitting failure									

Edge distance	$c_{cr,sp}$	[mm]	$1{,}5h_{ef}$
Spacing	$s_{cr,sp}$	[mm]	$3{,}0h_{ef}$
Partial safety factor	γ_{Ms} [1)]	[-]	1,8

[1)] In absence of national regulations

[2)] The partial safety factor γ_2=1,2 is included

[3)] The partial safety factor γ_2=1,4 is included

Table C7: Design method CEN/TS 1992-4 Characteristic values of resistance to shear load of threaded rod

Steel failure without lever arm									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$V_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
Partial safety factor	γ_{Ms} [1)]	[-]	1,67							
Steel grade **5.8**	$V_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **8.8**	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **10.9**	$V_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
Partial safety factor	γ_{Ms} [1)]	[-]	1,5							
Stainless steel grade **A4-70**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Stainless steel grade **A4-80**	$V_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **1.4529**	$V_{Rk,s}$	[kN]	13	20	30	55	86	124	161	196
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Ductility factor according to CEN/TS 1992-4-5 Section 6.3.2.1		k2	0,8							

Steel failure with lever arm									
Size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel grade **4.6**	$M^0_{Rk,s}$	[N.m]	15	30	52	133	260	449	666	900
Partial safety factor	γ_{Ms} [1)]	[-]	1,67							

Steel grade **5.8**	$M^0_{Rk,s}$	[N.m]	19	37	66	166	325	561	832	1125
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **8.8**	$M^0_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel grade **10.9**	$M^0_{Rk,s}$	[N.m]	37	75	131	333	649	1123	1664	2249
Partial safety factor	γ_{Ms} [1)]	[-]	1,50							
Stainless steel grade **A4-70**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Stainless steel grade **A4-80**	$M^0_{Rk,s}$	[N.m]	30	60	105	266	519	898	1332	1799
Partial safety factor	γ_{Ms} [1)]	[-]	1,33							
Stainless steel grade **1.4529**	$M^0_{Rk,s}$	[N.m]	26	52	92	233	454	786	1165	1574
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Concrete pryout failure										
Factor according to CEN/TS 1992-4-5 Section 6.3.3	k_3		2,0							
Partial safety factor	γ_{MP} [1)]	[-]	1,5							

Concrete edge failure								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
See section 6.3.4 of CEN/TS 1992-4-5									
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	30
Partial safety factor	γ_{Mc} [1)]	[-]	1,5						

[1)] In absence of national regulations

Table C8: Design method CEN/TS 1992-4
Characteristic values of resistance to shear load of rebar

Steel failure without lever arm								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$V_{Rk,s}$	[kN]	14	22	31	55	86	135	221
Partial safety factor	γ_{Ms} [1)]	[-]	1,5						

Ductility factor according to CEN/TS 1992-4-5 Section 6.3.2.1	K_2	0,8

Steel failure with lever arm								
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Rebar BSt 500 S	$M^0_{Rk,s}$	[N.m]	33	65	112	265	518	1013	2122
Partial safety factor	γ_{Ms} [1)]	[-]	1,5						
Concrete pryout failure									
Factor according to CEN/TS 1992-4-5 Section 6.3.3	K_3		2,0						
Partial safety factor	γ_M	[-]	1,5						

Concrete edge failure									
Size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
See section 6.3.4 of CEN/TS 1992-4-5									
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	30
Partial safety factor	γ_{Mc} [1)]	[-]	1,5						

[1)] In absence of national regulations

Table C9: Displacement of threaded rod under tension and shear load

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Non-cracked concrete										
Tension load	F	[kN]	6,3	7,9	11,9	15,9	23,8	29,8	37,7	45,6
Displacement	δ_{N0}	[mm]	0,3	0,3	0,3	0,3	0,4	0,5	0,5	0,5
	$\delta_{N\infty}$	[mm]	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
Shear load	F	[kN]	3,1	5,0	7,2	13,5	21,0	30,3	39,4	48,0
Displacement	δ_{V0}	[mm]	1,5	1,5	1,5	1,5	2,0	2,5	2,5	2,5
	$\delta_{V\infty}$	[mm]	2,3	2,3	2,3	2,3	3,0	3,8	3,8	3,8
Cracked concrete										
Tension load	F	[kN]		5,1	7,4	13,1	20,5	24,6		
Displacement	δ_{N0}	[mm]		0,4	0,7	0,7	0,7	0,6		

Table C10: Displacement of rebar under tension and shear load

Rebar size			**Ø8**	**Ø10**	**Ø12**	**Ø16**	**Ø20**	**Ø25**	**Ø32**
Non-cracked concrete									
Tension load	F	[kN]	7,9	9,9	13,9	23,8	29,8	55,6	55,
Displacement	δ_{N0}	[mm]	0,3	0,3	0,3	0,4	0,4	0,5	0,5

	$\delta_{N\infty}$	[mm]	0,5	0,5	0,5	0,5	0,5	0,5	0,5
Shear load	F	[kN]	5,9	9,3	13,3	23,7	37,0	57,9	94,
Displacement	δ_{V0}	[mm]	0,3	0,4	0,4	0,4	0,4	0,5	0,9
	$\delta_{V\infty}$	[mm]	0,5	0,6	0,6	0,6	0,6	0,8	1,4

Table C11: Characteristic values of resistance under seismic action category C1 for threaded rods

Size			**M10**	**M12**	**M16**	**M20**	**M24**
Tension load							
Steel failure							
Characteristic resistance grade **4.6**	$N_{Rk,s,seis}$	[kN]	23	34	63	98	141
Partial safety factor	γ_{Ms} [1)]	[-]	2,00				
Characteristic resistance grade **5.8**	$N_{Rk,s,seis}$	[kN]	29	42	79	123	177
Partial safety factor	γ_{Ms} [1)]	[-]	1,50				
Characteristic resistance grade **8.8**	$N_{Rk,s,seis}$	[kN]	46	67	126	196	282
Partial safety factor	γ_{Ms} [1)]	[-]	1,50				
Characteristic resistance grade **10.9**	$N_{Rk,s,seis}$	[kN]	58	84	157	245	353
Partial safety factor	γ_{Ms} [1)]	[-]	1,33				
Characteristic resistance **A2-70, A4-70**	$N_{Rk,s,seis}$	[kN]	41	59	110	172	247
Partial safety factor	γ_{Ms} [1)]	[-]	1,87				
Characteristic resistance **A4-80**	$N_{Rk,s,seis}$	[kN]	46	67	126	196	282
Partial safety factor	γ_{Ms} [1)]	[-]	1,60				
Characteristic resistance **1.4529**	$N_{Rk,s,seis}$	[kN]	41	59	110	172	247
Partial safety factor	γ_{Ms} [1)]	[-]	1,50				
Characteristic resistance **1.4565**	$N_{Rk,s,seis}$	[kN]	41	59	110	172	247
Partial safety factor	γ_{Ms} [1)]	[-]	1,87				
Combined pull-out and concrete cone failure							
Dry and wet concrete	$\tau_{Rk,seis,C1}$	[N/mm²]	3,9	3,9	3,9	3,9	3,9
Partial safety factor	γ_{Mc} [1)]	[-]	1,8 [2)]				
Flooded hole	$\tau_{Rk,seis,C1}$	[N/mm²]	3,9	3,9	3,9	3,9	3,9
Partial safety factor	γ_{Mc} [1)]	[-]	2,1 [3)]				

Shear load							
Steel failure without lever arm							
Characteristic resistance grade **4.6**	$V_{Rk,s,seis}$	[kN]	7	10	23	30	40
Partial safety factor	γ_{Ms} [1)]	[-]	1,67				
Characteristic resistance grade **5.8**	$V_{Rk,s,seis}$	[kN]	9	13	28	38	51

Partial safety factor	γ_{Ms}[1)]	[-]	1,25				
Characteristic resistance grade **8.8**	$V_{Rk,s,seis}$	[kN]	14	21	45	61	81
Partial safety factor	γ_{Ms}[1)]	[-]	1,25				
Characteristic resistance grade **10.9**	$V_{Rk,s,seis}$	[kN]	18	26	56	76	101
Partial safety factor	γ_{Ms}[1)]	[-]	1,50				
Characteristic resistance **A2-70**, **A4-70**	$V_{Rk,s,seis}$	[kN]	12	18	39	53	71
Partial safety factor	γ_{Ms}[1)]	[-]	1,56				
Characteristic resistance **A4-80**	$V_{Rk,s,seis}$	[kN]	14	21	45	61	81
Partial safety factor	γ_{Ms}[1)]	[-]	1,33				
Characteristic resistance **1.4529**	$V_{Rk,s,seis}$	[kN]	12	18	39	53	71
Partial safety factor	γ_{Ms}[1)]	[-]	1,25				
Characteristic resistance **1.4565**	$V_{Rk,s,seis}$	[kN]	12	18	39	53	71
Partial safety factor	γ_{Ms}[1)]	[-]	1,56				

[1)] In absence of national regulations
[2)] The partial safety factor γ_2=1,2 is included
[3)] The partial safety factor γ_2=1,4 is included

Note: Rebars are not qualified for seismic design

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ETAG 001, Part 1 “Anchors in general”, Part 5 “Bonded anchors”

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