



**Technical and Test Institute
for Construction Prague**

Prosecká 811/76a
190 00 Prague
Czech Republic
eota@tzus.cz



Member of



www.eota.eu

European Technical Assessment

ETA 17/0184 of 02/10/2017

Technical Assessment Body issuing the ETA: Technical and Test Institute
for Construction Prague

Trade name of the construction product

Rawplug R-HPTIIZF Zinc Flake
Throughbolts

**Product family to which the construction
product belongs**

Product area code: 33
Torque controlled expansion anchor
for use in cracked and uncracked concrete

Manufacturer

Rawplug S.A.
Ul. Kwidzyńska 6
51-416 Wrocław
Poland

Manufacturing plant

Manufacturing Plant No 2

**This European Technical Assessment
contains**

12 pages including 10 Annexes which form
an integral part of this assessment

**This European Technical Assessment is
issued in accordance with regulation
(EU) No 305/2011, on the basis of**

EAD 330232-00-0601

This version replaces

ETA 17/0184 issued on 20/03/2017

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full (excepted the confidential Annex(es) referred to above). However, partial reproduction may be made, with the written consent of the issuing Technical Assessment Body - Technical and Test Institute for Construction Prague. Any partial reproduction has to be identified as such

1. Technical description of the product

The Rawlplug R-HPTIIZF Zinc Flake Throughbolts are through-fixing torque-controlled expansion anchors in sizes of M8, M10, M12, M16 and M20. Each type comprises a special bolt with a taper, an expansion sleeve, a hexagonal nut and a washer. The anchors are made from carbon steel finished in zinc/aluminium coating.

The anchor is installed in a drilled hole; tightening the nut draws the cone into the sleeve. The expansion of this sleeve applies the anchorage.

The installed anchor is shown in Annex 1.

2. Specification of the intended use in accordance with the applicable EAD

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the products in relation to the expected economically reasonable working life of the works.

3. Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance (static and quasi-static loading)	See Annex C 1 and C 2
Displacement	See Annex C 1 and C 2
Characteristic resistance for seismic performance category C1	See Annex C 4

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1 according to EN 13501-1
Resistance to fire	Seen Annex C 3

4. Assessment and verification of constancy of performance (AVCP) system applied with reference to its legal base

According to the Decision 97/463/EC of the European Commission¹, the system 1 of assessment verification of constancy of performance (see Annex V to the Regulation (EU) No 305/2011) apply.

5. Technical details necessary for the implementation of the AVCP system, as provided in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Technical and Test Institute for Construction Prague.

Issued in Prague on 02.10.2017

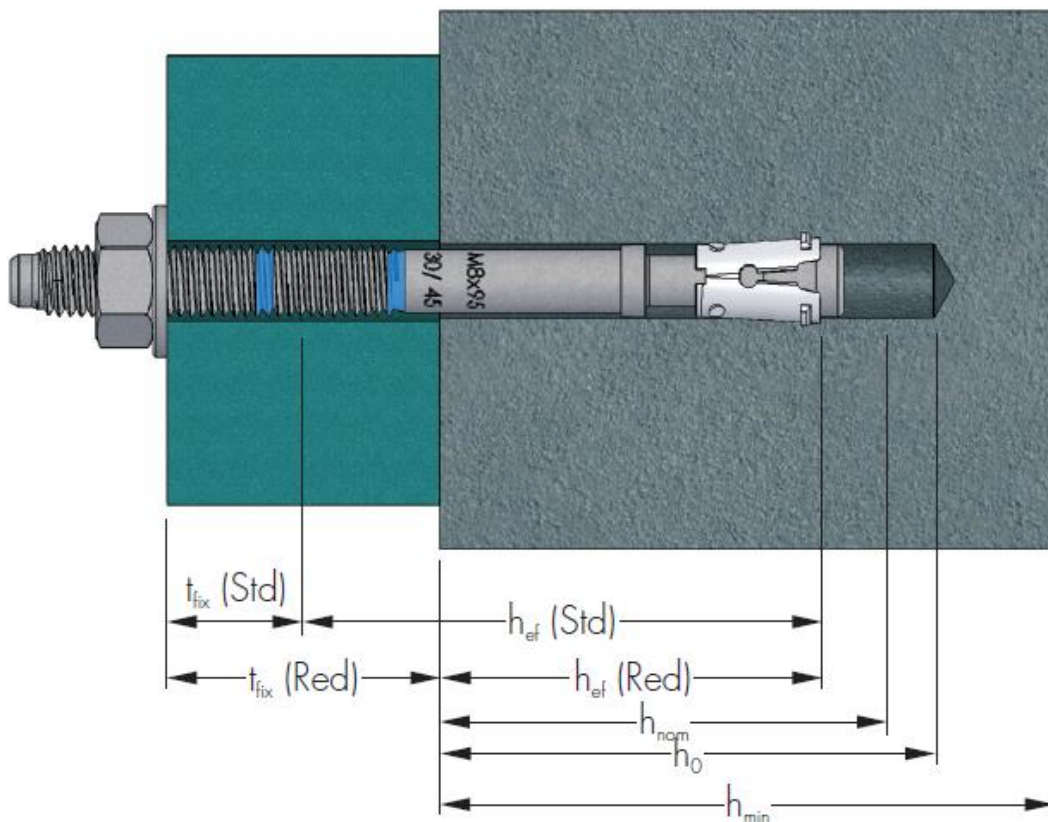
By

Ing. Mária Schaan

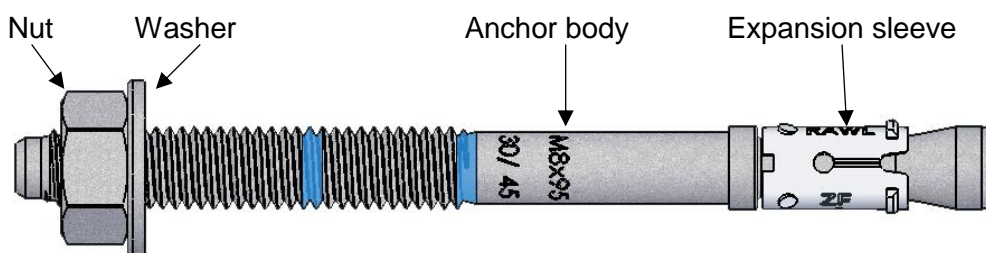
Head of the Technical Assessment Body

¹ Official Journal of the European Communities L 198/31 25.7.1997

Rawlplug R-HPTIIZF Zinc Flake Throughbolts - Installed anchor



Rawlplug R-HPTIIZF Zinc Flake Throughbolts - components



Rawlplug R-HPTIIZF Zinc Flake Throughbolts

Product description
Installed conditions and components

Annex A 1

Table A1 - Materials

Component	Material
Anchor body	Steel rod on coil cold forged bolts Steel grade C17C, according EN 10263-2
Expansion sleeve	Steel grade DC03, M8-M12 C590, M16-M20 C490, according EN 10139
Hexagonal nut	according DIN 934
Washer	according DIN 125A or DIN 9021

Table A2 – Material properties

Component	M8 - M16	M20
Anchor body – ultimate tensile strength [N/mm ²]	430	430
	M8 - M12	M16 - M20
Expansion sleeve – hardness [HV]	185 - 215	155 - 185

Table A3 – Marking

M8																		
Bolt length [mm]	60	65	75	80	85	90	95	100	105	115	120	140	150	160				
Head marking	B	b	C	d	D	e	E	F	f	G	H	K	L	M				
Bolt marking	-/10	-/15	10/25	15/30	20/35	25/40	30/45	35/50	40/55	50/65	55/70	75/90	85/100	95/110				
M10																		
Bolt length [mm]	65	80	85	90	95	115	120	130	140	150	180							
Head marking	B	D	d	e	E	G	H	J	K	L	P							
Bolt marking	-/5	-/20	5/25	10/30	15/35	35/55	40/60	50/70	60/80	70/90	100/120							
M12																		
Bolt length [mm]	80	100	105	110	115	120	125	135	140	150	160	180	200	220	240	250	260	280
Head marking	D	F	f	G	g	h	H	J	K	L	M	P	R	S	T	U	V	X
Bolt marking	-/5	5/25	10/30	15/35	20/40	25/45	30/50	40/60	45/65	55/75	65/85	85/105	105/125	125/145	145/165	155/175	165/185	185/205
M16																		
Bolt length [mm]	100	105	125	130	140	150	160	180	200	220	250	280	300					
Head marking	F	f	H	J	K	L	M	P	R	S	U	X	Y					
Bolt marking	-/5	-/10	5/25	10/30	20/40	30/50	40/60	60/80	80/100	100/120	130/150	160/180	180/200					
M20																		
Bolt length [mm]	125	140	160	165	180	200	250	300										
Head marking	H	K	M	m	P	R	U	Y										
Bolt marking	-/5	-/20	20/40	24/45	40/60	60/80	110/130	160/180										

Rawlplug R-HPTIIF Zinc Flake Throughbolts

Product description
Materials
Marking

Annex A 2

Specifications of intended use

Anchorage subject to:

- Static and quasi-static load
- Fire exposure
- Seismic performance category C1

Base materials

- Cracked or uncracked concrete.
- Reinforced or unreinforced normal weight concrete of strength class C20/25 at minimum and C50/60 at maximum according EN 206-1:2000-12.

Use conditions (Environmental conditions)

- Structures subject to dry internal conditions.

Design:

- The anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings.
- Anchorages under static or quasi-static actions are designed for design method A in accordance with FprEN 1992-4:2016
- Anchorages under fire exposure have to be designed in accordance with TR 020 and ETAG 001, Annex C or CEN/TS 1992-4:2009, Annex D
- Anchorages under seismic actions (cracked concrete) have to be designed in accordance with EOTA Technical Report TR 045 "Design of Metal Anchors under Seismic Action".

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Use of the anchor only as supplied by the manufacturer without exchanging any components of the anchor.
- Anchor installation in accordance with the manufacturer's specifications and drawings using the appropriate tools.
- Effective anchoring depth, edge distance and spacing not less than the specified values without minus tolerance.
- In case of aborted drill hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not in the direction of load application.

Rawlplug R-HPTIIF Zinc Flake Throughbolts

Intended use
Specifications

Annex B 1

Table B1 - Installation parameters

Size	Drill hole diameter	Bolt length	Thread length	Hole diameter in fixture	Standard embedment				Reduced embedment				Installation torque
					Min. hole depth	Nominal embedment depth	Effective embedment depth	Max. fixture thickness	Min. hole depth	Nominal embedment depth	Effective embedment depth	Max. fixture thickness	
	d ₀ [mm]	l [mm]	l _G [mm]	d _f [mm]	h ₀ [mm]	h _{nom} [mm]	h _{ef} [mm]	t _{fix} [mm]	h ₀ [mm]	h _{nom} [mm]	h _{ef} [mm]	t _{fix} [mm]	T _{inst} [N.m]
M8	8	60	25	9	-	-	-	-	50	40	32	10	10
		65	30	9	-	-	-	-	50	40	32	15	
		75	35	9	65	55	47	10	50	40	32	25	
		80	40	9	65	55	47	15	50	40	32	30	
		85	45	9	65	55	47	20	50	40	32	35	
		90	50	9	65	55	47	25	50	40	32	40	
		95	55	9	65	55	47	30	50	40	32	45	
		100	60	9	65	55	47	35	50	40	32	50	
		105	65	9	65	55	47	40	50	40	32	55	
		115	75	9	65	55	47	50	50	40	32	65	
		120	80	9	65	55	47	55	50	40	32	70	
140	100	9	65	55	47	75	50	40	32	90			
150	100	9	65	55	47	85	50	40	32	100			
160	100	9	65	55	47	95	50	40	32	110			
M10	10	65	21	11	-	-	-	-	59	49	39	5	20
		80	31	11	-	-	-	-	59	49	39	20	
		85	36	11	79	69	59	5	59	49	39	25	
		90	41	11	79	69	59	10	59	49	39	30	
		95	46	11	79	69	59	15	59	49	39	35	
		115	66	11	79	69	59	35	59	49	39	55	
		120	71	11	79	69	59	40	59	49	39	60	
		130	81	11	79	69	59	50	59	49	39	70	
		140	91	11	79	69	59	60	59	49	39	80	
150	101	11	79	69	59	70	59	49	39	90			
180	100	11	79	69	59	100	59	49	39	120			
M12	12	80	30	13	-	-	-	-	70	60	48	5	40
		100	40	13	90	80	68	5	70	60	48	25	
		105	45	13	90	80	68	10	70	60	48	30	
		110	50	13	90	80	68	15	70	60	48	35	
		115	55	13	90	80	68	20	70	60	48	40	
		120	60	13	90	80	68	25	70	60	48	45	
		125	65	13	90	80	68	30	70	60	48	50	
		135	75	13	90	80	68	40	70	60	48	60	
		140	80	13	90	80	68	45	70	60	48	65	
		150	90	13	90	80	68	55	70	60	48	75	
		160	100	13	90	80	68	65	70	60	48	85	
		180	100	13	90	80	68	85	70	60	48	105	
		200	100	13	90	80	68	105	70	60	48	125	
		220	100	13	90	80	68	125	70	60	48	145	
240	100	13	90	80	68	145	70	60	48	165			
250	100	13	90	80	68	155	70	60	48	175			
260	100	13	90	80	68	165	70	60	48	185			
280	100	13	90	80	68	185	70	60	48	205			
M16	16	100	30	18	-	-	-	-	90	80	65	5	100
		105	35	18	-	-	-	-	90	80	65	10	
		125	45	18	110	100	85	5	90	80	65	25	
		130	50	18	110	100	85	10	90	80	65	30	
		140	60	18	110	100	85	20	90	80	65	40	
		150	70	18	110	100	85	30	90	80	65	50	
		160	80	18	110	100	85	40	90	80	65	60	
		180	100	18	110	100	85	60	90	80	65	80	
		200	100	18	110	100	85	80	90	80	65	100	
		220	100	18	110	100	85	100	90	80	65	120	
250	100	18	110	100	85	130	90	80	65	150			
280	100	18	110	100	85	160	90	80	65	180			
300	100	18	110	100	85	180	90	80	65	200			
M20	20	125	50	22	-	-	-	-	110	100	80	5	180
		140	50	22	-	-	-	-	110	100	80	20	
		160	61	22	129	119	99	20	110	100	80	40	
		165	66	22	129	119	99	25	110	100	80	45	
		180	81	22	129	119	99	40	110	100	80	60	
		200	100	22	129	119	99	60	110	100	80	80	
		250	100	22	129	119	99	110	110	100	80	130	
300	100	22	129	119	99	160	110	100	80	180			

Rawlplug R-HPTIIF Zinc Flake Throughbolts

Intended use
Installation parameters

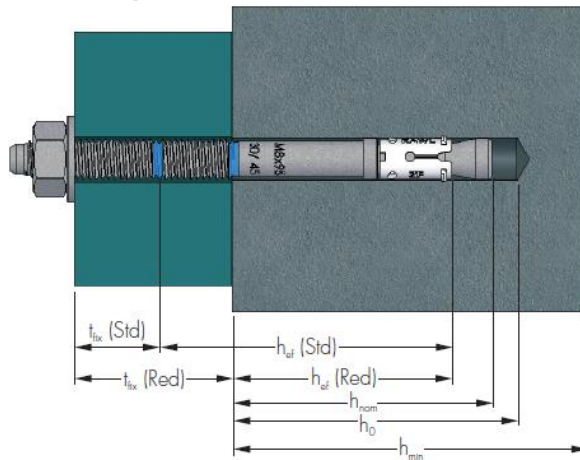
Annex B 2

Table B2 - Installation parameters – Minimum spacing and edge distance

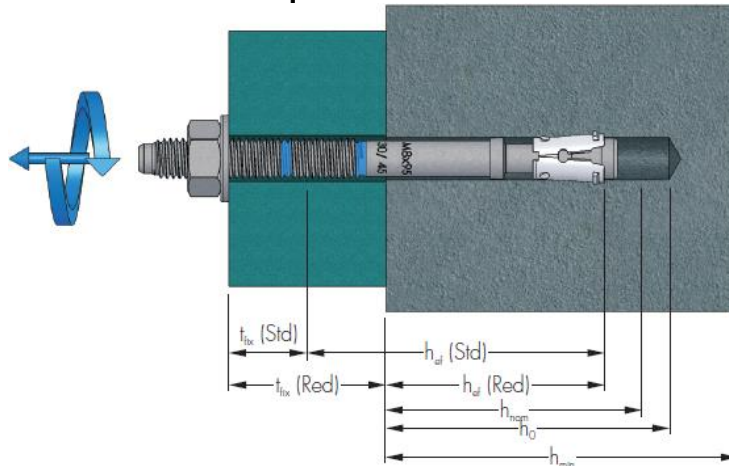
Size		M8		M10		M12		M16		M20	
		Red ¹⁾	Std	Red ¹⁾	Std	Red	Std	Red	Std	Red	Std
Minimum thickness of concrete member	h_{min} [mm]	100	100	100	120	100	140	130	170	160	200
Minimum spacing and edge distance in cracked concrete											
Minimum spacing	s_{min} [mm]	55	50	75	70	150	90	190	160	300	180
for edge distance $c \geq$	[mm]	45	50	60	65	100	80	125	130	200	150
Minimum edge distance	c_{min} [mm]	40	40	50	45	80	65	110	90	120	100
for spacing $s \geq$	[mm]	80	80	100	100	180	150	280	240	260	220
Minimum spacing and edge distance in uncracked concrete											
Minimum spacing	s_{min} [mm]	55	50	75	70	150	90	190	160	300	180
for edge distance $c \geq$	[mm]	45	50	60	65	100	80	125	130	200	150
Minimum edge distance	c_{min} [mm]	45	40	60	50	70	65	100	85	160	100
for spacing $s \geq$	[mm]	55	100	75	110	150	180	190	240	300	225

¹⁾ Use restricted to anchoring statically indeterminate structural components

Pre-torque installation



Post-torque installation



Rawlplug R-HPTIIF Zinc Flake Throughbolts

Intended use
Installation parameters

Annex B 2

Installation instructions

1. Drill a hole of required diameter and depth



2. Clear the hole of drilling dust and debris (using blowpump or equivalent method)



3. Lightly tap the throughbolt through the fixture into hole with a hammer, until fixing depth is reached



4. Tighten to the recommended torque



5. Assembled condition of anchor



Rawlplug R-HPTIIZF Zinc Flake Throughbolts

Intended use
Installation instructions

Annex B 3

Table C1 – Characteristic resistance under tension load

Steel failure			M8		M10		M12		M16		M20	
			Red ¹⁾	Std	Red ¹⁾	Std	Red	Std	Red	Std	Red	Std
Size												
Characteristic resistance	$N_{Rk,s}$	[kN]	11,0		17,5		25,8		45,8		70,0	
Partial safety factor	γ_{Ms}	[-]	1,4		1,4		1,4		1,4		1,4	

Pull-out failure												
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	3,0	5,0	6,0	9,0	9,0	12,0	16,0	20,0	-	30,0
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	7,5	9,0	9,0	12,0	12,0	20,0	-	35,0	-	-
Installation safety factor	$\gamma_2^{(2)} = \gamma_{inst}^{(3)(4)}$	[-]	1,2	1,2	1,2	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Increasing factor												
Cracked and uncracked concrete	C30/37		1,20	1,12	1,16	1,22	1,22	1,00	1,11	1,14	1,12	1,07
	C40/50	ψ_c	1,40	1,22	1,33	1,44	1,44	1,00	1,22	1,28	1,26	1,14
	C50/60		1,60	1,33	1,50	1,67	1,67	1,00	1,33	1,43	1,39	1,21

Concrete cone failure												
Characteristic resistance in cracked concrete C20/25	$N_{Rk,c}$	[kN]	-	-	-	-	-	-	-	-	25,8	-
Factor for cracked concrete	$k_1^{(2)} = k_{ucr}^{(3)}$	[-]	7,2									
	$k_{ucr,N}^{(4)}$		7,7									
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,c}$	[kN]	-	-	-	-	-	-	26,4	-	36,1	49,6
Factor for uncracked concrete	$k_1^{(2)} = k_{ucr}^{(3)}$	[-]	10,1									
	$k_{ucr,N}^{(4)}$		11,0									
Installation safety factor	$\gamma_2^{(2)} = \gamma_{inst}^{(3)(4)}$	[-]	1,2	1,2	1,2	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Effective anchorage depth	h_{ef}	[mm]	32	47	39	59	48	68	65	85	80	99
Spacing	$s_{cr,N}$	[mm]	96	141	117	177	144	204	195	255	240	297
Edge distance	$c_{cr,N}$	[mm]	48	71	59	89	72	102	98	128	120	149

Splitting failure												
Spacing	$s_{cr,sp}$	[mm]	170	220	200	300	250	340	320	430	410	530
Edge distance	$c_{cr,sp}$	[mm]	85	110	100	150	125	170	160	215	205	265
Installation safety factor	$\gamma_2^{(2)} = \gamma_{inst}^{(3)(4)}$	[-]	1,2	1,2	1,2	1,0	1,0	1,0	1,0	1,0	1,0	1,0

- ¹⁾ Use restricted to anchoring statically indeterminate structural components
- ²⁾ parameter for design according to EOTA ETAG 001 Annex C
- ³⁾ parameter for design according to CEN/TS 1992-4-4:2009
- ⁴⁾ parameter for design according to FprEN 1992-4:2016

Table C2 – Displacement under tension load

Size			M8		M10		M12		M16		M20	
			Red ¹⁾	Std	Red ¹⁾	Std	Red	Std	Red	Std	Red	Std
Tension load in cracked concrete	N	[kN]	1,2	2,0	2,4	4,3	4,3	5,7	7,6	9,5	12,3	14,3
Displacement	δ_{N0}	[mm]	0,6	0,8	0,3	1,0	0,5	0,7	0,3	0,4	0,4	0,4
	$\delta_{N\infty}$	[mm]	1,0	0,9	1,1	1,4	1,0	0,9	0,8	1,1	1,3	0,7
Tension load in uncracked concrete	N	[kN]	3,0	3,6	3,6	5,7	5,7	9,5	12,6	16,7	17,2	23,6
Displacement	δ_{N0}	[mm]	0,1	0,3	0,3	0,3	0,1	0,6	0,5	0,2	0,1	0,6
	$\delta_{N\infty}$	[mm]	1,0	0,9	1,1	1,4	1,0	0,9	0,8	1,1	1,3	0,7

- ¹⁾ Use restricted to anchoring statically indeterminate structural components

Rawplug R-HPTIIZF Zinc Flake Throughbolts	Annex C 1
Performances	
Characteristic resistance under tension load Displacement under tension load	

Table C3 – Characteristic resistance under shear load

Steel failure without lever arm			M8		M10		M12		M16		M20	
			Red ¹⁾	Std	Red ¹⁾	Std	Red	Std	Red	Std	Red	Std
Size												
Characteristic resistance	$V_{Rk,s}^0$ [kN]		8,4		13,3		19,3		35,5		55,7	
Ductility factor	k_7 [-]		0,8		0,8		0,8		0,8		0,8	
Partial safety factor	γ_{Ms} [-]		1,25		1,25		1,25		1,25		1,25	

Steel failure with lever arm			M8		M10		M12		M16		M20	
Characteristic resistance	$M_{Rk,s}^0$ [Nm]		18		35		62		155		304	
Partial safety factor	γ_{Ms} [-]		1,25		1,25		1,25		1,25		1,25	

Concrete pry-out failure			M8		M10		M12		M16		M20	
Characteristic resistance concrete C20/25	$V_{Rk,cp}$ [kN]		-		-		-		-		-	
Factor	k_8 [-]		1,0	1,0	1,0	1,0	1,0	2,0	2,0	2,0	2,0	2,0
Installation safety factor	$\gamma_2^{2)} = \gamma_{inst}^{3)4)}$ [-]		1,2	1,2	1,2	1,0	1,0	1,0	1,0	1,0	1,0	1,0

Concrete edge failure			M8		M10		M12		M16		M20	
Effective length of anchor	l_f [mm]		32	47	39	59	48	68	65	85	80	99
Anchor diameter	d_{nom} [mm]		8		10		12		16		20	
Installation safety factor	$\gamma_2^{2)} = \gamma_{inst}^{3)4)}$ [-]		1,2	1,2	1,2	1,0	1,0	1,0	1,0	1,0	1,0	1,0

- ¹⁾ Use restricted to anchoring statically indeterminate structural components
- ²⁾ parameter for design according to EOTA ETAG 001 Annex C
- ³⁾ parameter for design according to CEN/TS 1992-4-4:2009
- ⁴⁾ parameter for design according to FprEN 1992-4:2016

Table C4 – Displacement under shear load

Size			M8		M10		M12		M16		M20	
			Red ¹⁾	Std	Red ¹⁾	Std	Red	Std	Red	Std	Red	Std
Tension load in cracked and uncracked concrete	V [kN]		5,8	5,8	9,2	9,2	13,3	13,3	24,5	24,5	38,5	38,5
Displacement	δ_{v0} [mm]		1,2	1,2	1,5	1,5	2,0	2,0	2,4	2,4	2,6	2,6
	$\delta_{v\infty}$ [mm]		1,8	1,8	2,3	2,3	3,0	3,0	3,6	3,6	3,9	3,9

- ¹⁾ Use restricted to anchoring statically indeterminate structural components

Rawplug R-HPTIIF Zinc Flake Throughbolts	Annex C 2
Performances	
Characteristic resistance under shear load Displacement under shear load	

Table C5 – Characteristic values of resistance to tension load under fire exposure¹⁾

Size	M8		M10		M12		M16		M20		
	Red ²⁾	Std	Red ²⁾	Std	Red	Std	Red	Std	Red	Std	
Characteristic fire resistance duration at 30 minutes											
Steel failure	$N_{Rk,s,fi}$ [kN]	0,4		0,9		1,7		3,1		4,9	
Pull-out failure	$N_{Rk,p,fi}$ [kN]	0,8	1,3	1,5	2,3	2,3	3,0	4,0	5,0	-	-
Concrete cone failure	$N_{Rk,c,fi}$ [kN]	1,0	2,7	1,7	4,8	2,9	6,9	6,1	12,0	10,3	17,6
Characteristic fire resistance duration at 60 minutes											
Steel failure	$N_{Rk,s,fi}$ [kN]	0,3		0,8		1,3		2,4		3,7	
Pull-out failure	$N_{Rk,p,fi}$ [kN]	0,8	1,3	1,5	2,3	2,3	3,0	4,0	5,0	-	-
Concrete cone failure	$N_{Rk,c,fi}$ [kN]	1,0	2,7	1,7	4,8	2,9	6,9	6,1	12,0	10,3	17,6
Characteristic fire resistance duration at 90 minutes											
Steel failure	$N_{Rk,s,fi}$ [kN]	0,3		0,6		1,1		2,0		3,2	
Pull-out failure	$N_{Rk,p,fi}$ [kN]	0,8	1,3	1,5	2,3	2,3	3,0	4,0	5,0	-	-
Concrete cone failure	$N_{Rk,c,fi}$ [kN]	1,0	2,7	1,7	4,8	2,9	6,9	6,1	12,0	10,3	17,6
Characteristic fire resistance duration at 120 minutes											
Steel failure	$N_{Rk,s,fi}$ [kN]	0,2		0,5		0,8		1,6		2,5	
Pull-out failure	$N_{Rk,p,fi}$ [kN]	0,6	1,0	1,2	1,8	1,8	2,4	3,2	4,0	-	-
Concrete cone failure	$N_{Rk,c,fi}$ [kN]	0,8	2,2	1,4	3,9	2,3	5,5	4,9	9,6	8,2	14,0
Spacing	$S_{cr,N}$ [mm]	4 x h_{ef}									
	S_{min} [mm]	55	50	75	70	150	90	190	160	300	180
Edge distance	$C_{cr,N}$ [mm]	2 x h_{ef}									
	C_{min} [mm]	$C_{min} = 2 \times h_{ef}$ however if the fire attack is from more than one side, the edge distance of the anchor has to be ≥ 300 mm and $\geq 2 \times h_{ef}$									

- ¹⁾ In absence of other national regulations the partial safety factor for resistance under fire exposure, $\gamma_{M,fi} = 1,0$ is recommended
²⁾ Use restricted to anchoring statically indeterminate structural components

Table C6 – Characteristic values of resistance to shear load under fire exposure

Size	M8		M10		M12		M16		M20	
	Red ¹⁾	Std	Red ¹⁾	Std	Red	Std	Red	Std	Red	Std
Characteristic fire resistance duration at 30 minutes										
Steel failure without lever arm	$V_{Rk,s,fi}$ [kN]	0,4		0,9		1,7		3,1		4,9
Steel failure with lever arm	$M_{Rk,s,fi}$ [Nm]	0,4		1,1		2,6		6,7		13,0
Characteristic fire resistance duration at 60 minutes										
Steel failure without lever arm	$V_{Rk,s,fi}$ [kN]	0,3		0,8		1,3		2,4		3,7
Steel failure with lever arm	$M_{Rk,s,fi}$ [Nm]	0,3		1,0		2,0		5,0		9,7
Characteristic fire resistance duration at 90 minutes										
Steel failure without lever arm	$V_{Rk,s,fi}$ [kN]	0,3		0,6		1,1		2,0		3,2
Steel failure with lever arm	$M_{Rk,s,fi}$ [Nm]	0,3		0,7		1,7		4,3		8,4
Characteristic fire resistance duration at 120 minutes										
Steel failure without lever arm	$V_{Rk,s,fi}$ [kN]	0,2		0,5		0,8		1,6		2,5
Steel failure with lever arm	$M_{Rk,s,fi}$ [Nm]	0,2		0,6		1,3		3,3		6,5
Concrete pry-out failure										
Factor ²⁾	k_8 [-]	1,0	1,0	1,0	1,0	1,0	2,0	2,0	2,0	2,0
Concrete edge failure	The characteristic resistance $V_{Rk,c,fi}^0$ in concrete C20/25 to C50/60 is determined by: $V_{Rk,c,fi}^0 = 0,25 \times V_{Rk,c}^0$ and $V_{Rk,c,fi}^0 = 0,20 \times V_{Rk,c}^0$ with the initial value of the characteristic resistance $V_{Rk,c}^0$ in cracked concrete C20/25 under normal temperature									

- ¹⁾ Use restricted to anchoring statically indeterminate structural components
²⁾ The values of factor k_8 and relevant values of $N_{Rk,c,fi}$ given in the Table C5 have to be considered in the design

Rawplug R-HPTIIF Zinc Flake Throughbolts

Performances
Characteristic values of resistance under fire exposure

Annex C 3

Table C7 – Characteristic values of resistance under seismic action category C1

Size			M8		M10		M12		M16		M20	
			Red ¹⁾	Std	Red ¹⁾	Std	Red ¹⁾	Std	Red ¹⁾	Std	Red ¹⁾	Std
Tension load												
Steel failure												
Characteristic resistance	$N_{Rk,s,eq}$	[kN]	11,0		17,5		25,8		45,8		70,0	
Partial safety factor	$\gamma_{Ms,eq}$	[-]	1,4		1,4		1,4		1,4		1,4	
Pull-out failure												
Characteristic resistance in concrete C20/25	$N_{Rk,p,eq}$	[kN]	3,0	5,0	6,0	9,0	9,0	12,0	16,0	20,0	-	30,0
Installation safety factor	$\gamma_{Mp,eq}$	[-]	1,2	1,2	1,2	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Shear load												
Steel failure without lever arm												
Characteristic resistance	$V^0_{Rk,s,eq}$	[kN]	-	5,2	-	9,4	23,8		33,3		55,1	
Partial safety factor	$\gamma_{Ms,eq}$	[-]		1,25		1,25	1,25		1,25		1,25	

¹⁾ Use restricted to anchoring statically indeterminate structural components

Rawplug R-HPTIIZF Zinc Flake Throughbolts

Performances
Reduction factors for seismic design

Annex C 4