

R-HPTIIFZ Zinc Flake Throughbolt

Throughbolt anchor with corrosion-resistant coating for cracked and non-cracked concrete



Installation movie

Approvals and Reports

- ETA-12/0309; ETAG 001-2, Option 1
- AT-15-9327/2014



Product information

Features and benefits

- New generation of throughbolt with unique corrosion resistant coating of min. thickness 8 um
- High performance in cracked and non-cracked concrete confirmed by ETA Option 1
- Highest quality to receive optimal load capability
- For applications requiring fire resistance up to 120 minutes
- Suitable for reduced embedment to avoid contact with reinforcement
- Embedment depth markings help to ensure precise installation of the anchor
- Design of R-HPTIIFZ allows drilling and installing directly through the fixture and helps to reduce installation time

Applications

- Cladding restraints
- Consoles
- Barriers
- Structural steel
- Curtain walling
- Hand rails
- Heavy Plant
- Balustrading
- Passenger lifts
- Facades

Base materials

Approved for use in:

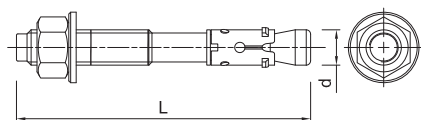
- Cracked concrete C20/25-C50/60
- Non-cracked concrete C20/25-C50/60

Installation guide



1. Drill a hole of required diameter and depth
2. Clear the hole of drilling dust and debris (using blow pump and brush 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

Product information

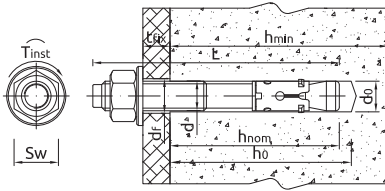


Size	Product Code	Anchor		Fixture		
		Diameter	Length	Max. thickness		Hole diameter
		d [mm]	L [mm]	t _{fix,r} [mm]	t _{fix,s} [mm]	d _f [mm]
M8	R-HPTIIFZ-08065/15	8	65	15	-	9
	R-HPTIIFZ-08080/15	8	80	30	15	9
	R-HPTIIFZ-08085/20	8	85	35	20	9
	R-HPTIIFZ-08100/35	8	100	50	35	9
M10	R-HPTIIFZ-08115/50*	8	115	65	50	9
	R-HPTIIFZ-10065/5	10	65	5	-	11
	R-HPTIIFZ-10080/20	10	80	20	-	11
	R-HPTIIFZ-10095/15	10	95	35	15	11
	R-HPTIIFZ-10115/35	10	115	55	35	11
	R-HPTIIFZ-10130/50	10	130	70	50	11
M12	R-HPTIIFZ-12080/5	12	80	5	-	13
	R-HPTIIFZ-12100/5	12	100	25	5	13
	R-HPTIIFZ-12120/25	12	120	45	25	13
	R-HPTIIFZ-12135/40	12	135	60	40	13
M16	R-HPTIIFZ-12150/55	12	150	75	55	13
	R-HPTIIFZ-16100/5	16	100	5	-	18
	R-HPTIIFZ-16105/10	16	105	10	-	18
	R-HPTIIFZ-16140/20	16	140	40	20	18
	R-HPTIIFZ-16160/40	16	160	60	40	18
M20	R-HPTIIFZ-16180/60	16	180	80	60	18
	R-HPTIIFZ-20125/5	20	125	5	-	22
	R-HPTIIFZ-20160/20	20	160	40	20	22

* AT-ITB Polish Technical Approval AT-15-9327/2014

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Installation data



Size			M8	M10	M12	M16	M20
Thread diameter	d	[mm]	8	10	12	16	20
Hole diameter in substrate	d ₀	[mm]	8	10	12	16	20
Installation torque	T _{inst}	[Nm]	10	20	40	100	180
Wrench size	s _w	[mm]	13	17	19	24	32
STANDARD EMBEDMENT DEPTH							
Min. hole depth in substrate	h _{0,s}	[mm]	60	75	85	105	125
Installation depth	h _{nom,s}	[mm]	55	69	80	100	119
Min. substrate thickness	h _{min,s}	[mm]	100	120	140	170	200
Min. spacing (Non-cracked concrete)	s _{min,r}	[mm]	50	70	90	160	180
Min. spacing (Cracked concrete)	s _{min,r}	[mm]	50	70	90	160	180
Min. edge distance (Non-cracked concrete)	c _{min,r}	[mm]	40	50	65	100	120
Min. edge distance (Cracked concrete)	c _{min,r}	[mm]	40	45	65	90	100
REDUCED EMBEDMENT DEPTH							
Min. hole depth in substrate	h _{0,r}	[mm]	45	55	65	85	105
Installation depth	h _{nom,r}	[mm]	40	49	60	80	100
Min. substrate thickness	h _{min,r}	[mm]	100	100	100	130	160
Min. spacing (Non-cracked concrete)	s _{min,r}	[mm]	55	75	150	190	300
Min. spacing (Cracked concrete)	s _{min,r}	[mm]	55	75	150	190	300
Min. edge distance (Non-cracked concrete)	c _{min,r}	[mm]	45	60	100	125	200
Min. edge distance (Cracked concrete)	c _{min,r}	[mm]	40	50	80	110	120

Mechanical properties

Size			M8	M10	M12	M16	M20
Nominal ultimate tensile strength	F _{tk}	[N/mm ²]	430	430	430	430	480
Yield strength	F _{yk}	[N/mm ²]	323	323	323	323	360
Cross sectional area	A _s	[mm ²]	36.6	58.0	84.3	157.0	157.0
Elastic section modulus	W _{el}	[mm ³]	50.27	98.17	169.65	402.12	785.40
Characteristic bending resistance	M ⁰ _{Rk,s}	[Nm]	25.94	50.66	87.54	207.50	452.39
Design bending resistance	M	[Nm]	17.29	33.77	58.36	138.33	301.59

Design performance data

Data for anchor calculation acc. to ETAG 001 p. 5.2 - Method A

Size			M8	M10	M12	M16	M20	M8	M10	M12	M16	M20
			STANDARD ANCHORAGE					REDUCED ANCHORAGE				
Embedment depth	h _{ef}	[mm]	47	59	68	85	99	32	39	48	65	80
TENSION LOAD												
STEEL FAILURE (ETAG 001, zař. C, p.5.2.2.2.)												
Characteristic resistance	N _{Rk,s}	[kN]	15.80	25.20	37.30	66.10	101.00	15.80	25.20	37.30	66.10	101.00
Design resistance $V_{Ms} = 1.4$	V _{M_s}	-	1.4					1.4				
PULL-OUT FAILURE; CONCRETE C20/25 (ETAG 001, zař. C, p.5.2.2.3.)												
Characteristic resistance - cracked concrete	N _{Rk,p}	[kN]	5.00	9.00	12.00	20.00	30.00	3.00	6.00	9.00	16.00	¹⁾
Characteristic resistance - non-cracked concrete	N _{Rk,p}	[kN]	9.00	12.00	20.00	35.00	¹⁾	7.50	9.00	12.00	¹⁾	¹⁾
Partial safety factor	V _{Mp}	-	1.8	1.5	1.5	1.5	1.5	1.8	1.8	1.5	1.5	1.5
Increasing factor	ψ _c C30/37	-	1.12	1.22	1.0	1.14	1.07	1.2	1.16	1.22	1.11	1.12
	ψ _c C40/50	-	1.22	1.44	1.0	1.28	1.14	1.4	1.33	1.44	1.22	1.26
	ψ _c C50/60	-	1.33	1.67	1.0	1.43	1.21	1.6	1.5	1.67	1.33	1.39
CONCRETE CONE FAILURE (ETAG 001, zař. C, p.5.2.2.4.)												
Spacing	s _{cr,N}	[mm]	141	177	204	255	297	96	117	144	195	240
Edge distance	c _{cr,N}	[mm]	71	89	102	128	149	48	59	72	98	120
Partial safety factor	V _{Mc}	-	1.8	1.5	1.5	1.5	1.5	1.8	1.8	1.5	1.5	1.5
CONCRETE SPLITTING FAILURE (ETAG 001, zař. C, p.5.2.2.6.)												
Spacing	s _{cr,sp}	[mm]	220	300	340	430	530	170	200	250	320	410
Edge distance	c _{cr,sp}	[mm]	110	150	170	215	265	85	100	125	160	205
Partial safety factor	V _{Msp}	-	1.8	1.5	1.5	1.5	1.5	1.8	1.8	1.5	1.5	1.5

Design performance data (cont.)

Data for anchor calculation acc. to ETAG 001 p. 5.2 - Method A

Size			M8	M10	M12	M16	M20	M8	M10	M12	M16	M20
SHEAR LOAD												
STEEL FAILURE (ETAG 001, zař. C, p.5.2.3.2.)												
Characteristic resistance without lever arm	$V_{Rk,s}$	[kN]	10.1	16.0	23.3	43.0	67.4	10.1	16.0	23.3	43.0	67.4
Characteristic resistance with lever arm	$M^0_{Rk,s}$	[Nm]	19.00	38.00	67.00	167.00	328.00	19.00	38.00	67.00	167.00	328.00
Partial safety factor	γ_{Ms}	-	1.25				1.25					
CONCRETE PRY-OUT FAILURE (ETAG 001, zař. C, p.5.2.3.3.)												
Factor	k	-	1	1	2	2	2	1	1	1	2	2
Partial safety factor	γ_{Mc}	-	1.8	1.5	1.5	1.5	1.5	1.8	1.8	1.5	1.5	1.5
CONCRETE EDGE FAILURE (ETAG 001, zař. C, p.5.2.3.4.)												
	d_{nom}	[mm]	8	10	12	16	20	8	10	12	16	20
Effective anchor length	l_f	[mm]	47	59	68	85	99	32	39	48	65	80
Partial safety factor	γ_{Mc}	-	1.8	1.5	1.5	1.5	1.5	1.8	1.8	1.5	1.5	1.5

¹⁾ Failure is not decisive

Basic performance data

STANDARD EMBEDMENT DEPTH NON-CRACKED CONCRETE

Performance data for single anchor without influence of edge distance and spacing

Size		M8	M10	M12	M16	M16
Standard embedment depth h_{ef}	[mm]	47	59	68	85	99
MEAN ULTIMATE LOAD						
TENSION LOAD $N_{Ru,m}$	[kN]	12.44	20.63	27.68	45.50	64.80
SHEAR LOAD $V_{Ru,m}$	[kN]	12.15	19.24	27.95	51.54	80.85
CHARACTERISTIC LOAD						
TENSION LOAD N_{Rk}	[kN]	9.00	12.00	20.00	35.00	49.74
SHEAR LOAD V_{Rk}	[kN]	9.00	12.00	23.30	43.00	67.40
DESIGN LOAD						
TENSION LOAD N_{Rd}	[kN]	5.00	8.00	13.33	23.33	33.16
SHEAR LOAD V_{Rd}	[kN]	5.00	8.00	18.64	34.40	53.92
RECOMMENDED LOAD*						
TENSION LOAD N_{Rec}	[kN]	3.57	5.71	9.52	16.67	23.69
SHEAR LOAD V_{Rec}	[kN]	3.57	5.71	13.31	24.57	38.51

* Partial safety factor 1.4

steel failure
 concrete cone failure
 concrete pry-out failure

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing



EDGE DISTANCE IN TENSION

Reduction factors for edge distance $<c_{cr,N}$ applicable to N_{Rd} or N_{rec} for non-cracked concrete.

Table only valid for one edge distance $<c_{cr,N}$ and $s \geq s_{cr,N}$. For other cases use the Rawplug EasyFix - Anchor Calculator.

c_N [mm]	M8		M10		M12		M16		M20	
	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}
30										
40	0.91	0.91								
45	0.97	0.97								
50	1.00	1.00	1.00	1.00						
70					0.91	0.91				
75					0.95	0.95				
90					1.00	1.00				
100							0.87	0.87		
120							1.00	1.00	0.85	0.85
140									0.95	0.95
160									1.00	1.00

Basic performance data (cont.)

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing

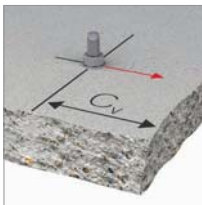


SPACING IN TENSION

Reduction factors for spacing $< s_{cr,N}$ applicable to N_{Rd} or N_{rec} for non-cracked concrete.

Table only valid for one spacing $< s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

s_N [mm]	M8		M10		M12		M16		M20	
	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}
50	0.90	0.90								
55	0.92	0.92								
60	0.95	0.95								
70	0.99	0.99	1.00	1.00						
75	1.00	1.00								
90					0.86	0.86				
100					0.89	0.89				
120					0.94	0.94				
140					1.00	1.00				
160							0.85	0.85		
180							0.89	0.89	0.80	0.80
200							0.93	0.93	0.83	0.83
250							1.00	1.00	0.92	0.92
300									1.00	1.00



EDGE DISTANCE IN SHEAR

Reduction factors for edge distance $< c_{min}$ applicable to V_{Rd} or V_{rec} for non-cracked concrete.

Table only valid for one edge distance $< c_{min}$ and $s \geq 3c_v$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

c_v [mm]	M8		M10		M12		M16		M20	
	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}
40	0.56	0.56								
45	0.65	0.65								
50	0.75	0.75	0.61	0.61						
55	0.86	0.86	0.69	0.69						
60	0.96	0.96	0.78	0.78						
70	1.12	1.12	0.95	0.95	0.52	0.52				
75			1.05	1.05	0.57	0.57				
90			1.33	1.26	0.72	0.72				
100				1.33	0.83	0.80	0.49	0.49		
120					1.00	0.94	0.62	0.61	0.42	0.42
140						1.00	0.77	0.69	0.52	0.51
160							0.91	0.77	0.62	0.56
180							1.00	0.85	0.72	0.62
200								0.93	0.83	0.68
250								1.00	1.00	0.82
300										0.96
350										1.00

Basic performance data (cont.)

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing



SPACING IN SHEAR

Reduction factors for edge distance $> s_{min}$ applicable to V_{Rd} and V_{Rec} for non-cracked concrete.

Table only valid for one spacing $< s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

s_v [mm]	M8		M10		M12		M16		M20	
	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}
50	0.90	0.90								
55	0.92	0.92								
60	0.95	0.95								
70	0.99	0.99	1.06	1.06						
75	1.02	1.02	1.08	1.08						
90	1.09	1.09	1.14	1.14	1.00	1.00				
100	1.12	1.12	1.19	1.19						
120			1.27	1.27						
140			1.33	1.33						
160							0.96	0.90		
180							0.99	0.94	0.79	0.74
200							1.00	0.97	0.81	0.77
250								1.00	0.87	0.83
300									0.94	0.89
350									1.00	0.95
400										1.00

STANDARD EMBEDMENT DEPTH CRACKED CONCRETE

Performance data for single anchor without influence of edge distance and spacing

Size		M8	M10	M12	M16	M20
Standard embedment depth h_{ef}	[mm]	47	59	68	85	99
MEAN ULTIMATE LOAD						
TENSION LOAD $N_{Ru,m}$	[kN]	7.52	12.45	19.93	27.25	41.86
SHEAR LOAD $V_{Ru,m}$	[kN]	12.15	19.24	27.95	51.54	80.85
CHARACTERISTIC LOAD						
TENSION LOAD N_{Rk}	[kN]	5.00	9.00	12.00	20.00	30.00
SHEAR LOAD V_{Rk}	[kN]	5.00	9.00	23.30	40.00	60.00
DESIGN LOAD						
TENSION LOAD N_{Rd}	[kN]	2.78	6.00	8.00	13.33	20.00
SHEAR LOAD V_{Rd}	[kN]	2.78	6.00	16.00	26.67	40.00
RECOMMENDED LOAD*						
TENSION LOAD N_{Rec}	[kN]	1.98	4.29	5.71	9.52	14.29
SHEAR LOAD V_{Rec}	[kN]	1.99	4.29	11.43	19.05	28.57

* Partial safety factor 1.4

■ steel failure

■ concrete pry-out failure

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing



EDGE DISTANCE IN TENSION

Reduction factors for edge distance $< c_{cr,N}$ applicable to N_{Rd} or N_{Rec} for cracked concrete.

Table only valid for one edge distance $< c_{cr,N}$ and $s \geq s_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

c_N [mm]	M8		M10		M12		M16		M20	
	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}
40	1.00	1.00								
45			0.93	0.93						
50			0.98	0.98						
55			1.00	1.00						
70					1.00	1.00				
90							1.00	1.00		
100									0.89	0.89
120									1.00	1.00

Basic performance data (cont.)

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing



SPACING IN TENSION

Reduction factors for spacing $< s_{cr,N}$ applicable to N_{Rd} or N_{rec} for cracked concrete.

Table only valid for one spacing $< s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

s_N [mm]	M8		M10		M12		M16		M16	
	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}
50	1.00	1.00								
70			1.00	1.00						
90					1.00	1.00				
160							1.00	1.00		
180									0.94	0.94
200									0.98	0.98
250									1.00	1.00



EDGE DISTANCE IN SHEAR

Reduction factors for edge distance $< c_{min}$ applicable to V_{Rd} or V_{rec} for cracked concrete.

Table only valid for one edge distance $< c_{min}$ and $s \geq 3c_v$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

c_v [mm]	M8		M10		M12		M16		M20	
	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}
40	0.71	0.71								
45	0.83	0.83	0.50	0.50						
50	0.96	0.96	0.58	0.58						
55	1.09	1.09	0.65	0.65						
60	1.23	1.23	0.73	0.73						
70	1.52	1.48	0.90	0.90	0.37	0.37				
75	1.66	1.57	0.99	0.99	0.40	0.40				
90	1.94	1.84	1.26	1.19	0.51	0.51	0.33	0.33		
100	2.02	2.02	1.46	1.30	0.59	0.57	0.37	0.37	0.27	0.27
120			1.70	1.53	0.75	0.67	0.47	0.46	0.34	0.34
140			1.78	1.75	0.93	0.76	0.58	0.52	0.41	0.40
160				1.78	1.00	0.85	0.70	0.59	0.49	0.45
180						0.94	0.82	0.65	0.57	0.49
200						1.00	0.94	0.71	0.66	0.54
250							1.08	0.86	0.89	0.65
300								1.01	1.12	0.76
350								1.08		0.87
400										0.98
450										1.08
500										1.12



SPACING IN SHEAR

Reduction factors for edge distance $> s_{min}$ applicable to V_{Rd} and V_{rec} for cracked concrete.

Table only valid for one spacing $< s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

s_v [mm]	M8		M10		M12		M16		M20	
	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}	$h > 1.5c_v$	h_{min}
50	1.15	1.15								
55	1.19	1.19								
60	1.22	1.22								
70	1.28	1.28	1.01	1.01						
75	1.31	1.31	1.03	1.03						
90	1.40	1.40	1.09	1.09	0.78	0.75				
100	1.46	1.46	1.13	1.13	0.80	0.77				
120	1.58	1.58	1.21	1.21	0.84	0.81				
140	1.70	1.70	1.29	1.29	0.88	0.84				
160	1.82	1.82	1.37	1.37	0.92	0.88	0.73	0.69		
180	1.94	1.94	1.45	1.45	0.96	0.92	0.76	0.71	0.63	0.59
200	2.02	2.02	1.53	1.53	1.00	0.96	0.78	0.74	0.65	0.61
250			1.74	1.74		1.00	0.85	0.80	0.70	0.66
300			1.78	1.78			0.92	0.87	0.75	0.71
350							0.99	0.93	0.80	0.75
400							1.05	0.99	0.85	0.80
450							1.08	1.06	0.90	0.85
500								1.08	0.95	0.90
550									1.00	0.94
600									1.05	0.99
700									1.12	1.09

Basic performance data (cont.)

REDUCED EMBEDMENT DEPTH NON-CRACKED CONCRETE

Performance data for single anchor without influence of edge distance and spacing

Size		M8	M10	M12	M16	M20
Standard embedment depth h_{ef}	[mm]	32	39	48	65	80
MEAN ULTIMATE LOAD						
TENSION LOAD $N_{Ru,m}$	[kN]	9.55	13.59	17.57	34.50	47.10
SHEAR LOAD $V_{Ru,m}$	[kN]	12.15	19.24	27.95	51.54	80.85
CHARACTERISTIC LOAD						
TENSION LOAD N_{Rk}	[kN]	7.50	9.00	12.00	26.40	36.10
SHEAR LOAD V_{Rk}	[kN]	7.50	9.00	12.00	43.00	67.40
DESIGN LOAD						
TENSION LOAD N_{Rd}	[kN]	4.17	5.00	8.00	17.60	24.07
SHEAR LOAD V_{Rd}	[kN]	4.17	5.00	8.00	34.40	48.13
RECOMMENDED LOAD*						
TENSION LOAD N_{Rec}	[kN]	2.98	3.57	5.71	12.57	17.19
SHEAR LOAD V_{Rec}	[kN]	2.98	3.57	5.71	24.57	34.38

* Partial safety factor 1.4

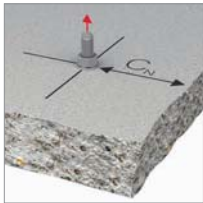
■ steel failure

■ concrete cone failure

■ concrete pry-out failure

EDGE DISTANCE AND SPACING

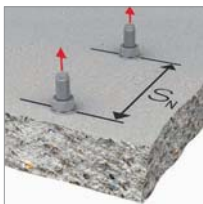
Reduction resistance factors for edge distance and spacing



EDGE DISTANCE IN TENSION

Reduction factors for edge distance $<c_{cr,N}$ applicable to N_{Rd} or N_{Rec} for cracked non-concrete. Table only valid for one edge distance $<c_{cr,N}$ and $s \geq s_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

c_N [mm]	M8		M10		M12		M16		M20	
	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}
45	0.76	0.76								
50	0.82	0.82								
55	0.86	0.86								
60	0.91	0.91	0.96	0.96						
70	0.99	0.99	1.00	1.00						
75	1.00	1.00								
100					1.00	1.00				
140							1.00	1.00		
200									1.00	1.00



SPACING IN TENSION

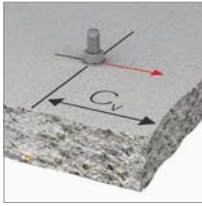
Reduction factors for spacing $<s_{cr,N}$ applicable to N_{Rd} or N_{Rec} for non-cracked concrete. Table only valid for one spacing $<s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

s_N [mm]	M8		M10		M12		M16		M20	
	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}
55	0.63	0.63								
60	0.65	0.65								
70	0.70	0.70								
75	0.72	0.72	0.78	0.78						
90	0.78	0.78	0.84	0.84						
100	0.82	0.82	0.88	0.88						
120	0.91	0.91	0.96	0.96						
140	0.99	0.99	1.00	1.00						
160	1.00	1.00			1.00	1.00				
200							0.84	0.84		
250							0.94	0.94		
300							1.00	1.00	1.00	1.00

Basic performance data (cont.)

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing



EDGE DISTANCE IN SHEAR

Reduction factors for edge distance $< c_{\min}$ applicable to V_{Rd} or V_{rec} for non-cracked concrete. Table only valid for one edge distance $< c_{\min}$ and $s \geq 3c_v$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

c_v [mm]	M8		M10		M12		M16		M20	
	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}
45	0.74	0.74								
50	0.82	0.82								
55	0.86	0.86								
60	0.91	0.91	0.96	0.96						
70	0.99	0.99	1.04	1.04						
75	1.03	1.03	1.08	1.08						
90	1.16	1.16	1.21	1.21						
100	1.24	1.24	1.29	1.29	1.24	1.24				
120	1.35	1.35	1.45	1.45	1.38	1.38				
140			1.61	1.61	1.52	1.52	0.73	0.58		
160			1.77	1.77	1.67	1.67	0.88	0.65		
180			1.78	1.78	1.81	1.81	1.00	0.71		
200					1.94	1.94		0.78	0.80	0.59
250								0.95	1.00	0.71
300								1.00		0.83
350										0.95
400										1.00



SPACING IN SHEAR

Reduction factors for edge distance $> s_{\min}$ applicable to V_{Rd} and V_{rec} for non-cracked concrete. Table only valid for one spacing $< s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

s_v [mm]	M8		M10		M12		M16		M20	
	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}
55	0.63	0.63								
60	0.65	0.65								
70	0.70	0.70								
75	0.72	0.72	0.78	0.78						
90	0.78	0.78	0.84	0.84						
100	0.82	0.82	0.88	0.88						
120	0.91	0.91	0.96	0.96						
140	0.99	0.99	1.04	1.04						
160	1.07	1.07	1.12	1.12	1.09	1.09				
180	1.16	1.16	1.21	1.21	1.17	1.17				
200	1.24	1.24	1.29	1.29	1.24	1.24	0.76	0.72		
250	1.35	1.35	1.49	1.49	1.42	1.42	0.84	0.79		
300			1.69	1.69	1.60	1.60	0.91	0.86	0.74	0.70
350			1.78	1.78	1.78	1.78	0.99	0.93	0.80	0.75
400					1.94	1.94	1.00	1.00	0.86	0.81
450									0.91	0.86
500									0.97	0.91
550									1.00	0.97
600										1.00

Basic performance data (cont.)

REDUCED EMBEDMENT DEPTH CRACKED CONCRETE

Performance data for single anchor without influence of edge distance and spacing

Size		M8	M10	M12	M16	M16
Standard embedment depth h_{ef}	[mm]	32	39	48	65	80
MEAN ULTIMATE LOAD						
TENSION LOAD $N_{Ru,m}$	[kN]	4.79	8.58	12.82	26.75	32.66
SHEAR LOAD $V_{Ru,m}$	[kN]	12.15	19.24	27.95	51.54	80.85
CHARACTERISTIC LOAD						
TENSION LOAD N_{Rk}	[kN]	3.00	6.00	9.00	16.00	25.80
SHEAR LOAD V_{Rk}	[kN]	3.00	6.00	9.00	32.00	51.60
DESIGN LOAD						
TENSION LOAD N_{Rd}	[kN]	1.67	3.33	6.00	10.67	17.20
SHEAR LOAD V_{Rd}	[kN]	1.67	3.33	6.00	21.33	34.50
RECOMMENDED LOAD*						
TENSION LOAD N_{Rec}	[kN]	1.19	2.38	4.29	7.62	12.29
SHEAR LOAD V_{Rec}	[kN]	1.19	2.38	4.29	15.24	24.64

* Partial safety factor 1.4

■ steel failure ■ concrete pry-out failure

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing



EDGE DISTANCE IN TENSION

Reduction factors for edge distance $<c_{cr,N}$ applicable to N_{Rd} or N_{Rec} for cracked concrete. Table only valid for one edge distance $<c_{cr,N}$ and $s \geq s_{cr,N}$. For other cases use the Rawplug EasyFix - Anchor Calculator.

c_N [mm]	M8		M10		M12		M16		M20	
	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}
40	1.00	1.00								
50			0.90	0.90						
55			0.97	0.97						
60			1.00	1.00						
90					1.00	1.00				
120							1.00	1.00	0.64	0.64
140									0.70	0.70
160									0.75	0.75
200									0.80	0.80
250									0.86	0.86
300									0.99	0.99
350									1.00	1.00



SPACING IN TENSION

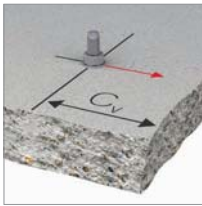
Reduction factors for spacing $<s_{cr,N}$ applicable to N_{Rd} or N_{Rec} for cracked concrete. Table only valid for one spacing $<s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawplug EasyFix - Anchor Calculator.

s_N [mm]	M8		M10		M12		M16		M20	
	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}	$h > 1.84h_{min}$	h_{min}
55	1.00	1.00								
75			0.83	0.83						
90			0.90	0.90						
100			0.94	0.94						
120			1.00	1.00						
160					1.00	1.00				
200							0.99	0.99		
250							1.00	1.00		
300									1.00	1.00

Basic performance data (cont.)

EDGE DISTANCE AND SPACING

Reduction resistance factors for edge distance and spacing



EDGE DISTANCE IN SHEAR

Reduction factors for edge distance $< c_{\min}$ applicable to V_{Rd} or V_{rec} for cracked concrete.
Table only valid for one edge distance $< c_{\min}$ and $s \geq 3c_v$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

c_v [mm]	M8		M10		M12		M16		M20	
	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}
40	1.11	1.11								
45	1.30	1.30								
50	1.46	1.46	0.80	0.80						
55	1.54	1.54	0.91	0.91						
60	1.61	1.61	1.02	1.02						
70	1.76	1.76	1.12	1.12						
75	1.84	1.84	1.16	1.16						
90	2.06	2.06	1.29	1.29	1.11	1.08				
100	2.21	2.21	1.38	1.38	1.18	1.18				
120	2.51	2.51	1.55	1.55	1.31	1.31	0.57	0.48	0.29	0.27
140	2.81	2.81	1.72	1.72	1.45	1.45	0.70	0.55	0.35	0.31
160	3.11	3.11	1.90	1.90	1.59	1.59	0.83	0.61	0.42	0.34
180	3.37	3.37	2.07	2.07	1.72	1.72	0.98	0.68	0.49	0.38
200			2.24	2.24	1.86	1.86	1.13	0.75	0.57	0.42
250			2.67	2.67	2.20	2.20	1.34	0.91	0.77	0.50
300					2.54	2.54		1.06	0.99	0.59
350					2.59	2.59		1.22	1.00	0.67
400							1.34			0.76
450										0.84
500										0.92
550										1.00



SPACING IN SHEAR

Reduction factors for edge distance $> s_{\min}$ applicable to V_{Rd} and V_{rec} for cracked concrete.
Table only valid for one spacing $< s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawlplug EasyFix - Anchor Calculator.

s_v [mm]	M8		M10		M12		M16		M20	
	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}	$h > 1.5c_v$	h_{\min}
55	1.13	1.13								
60	1.16	1.16								
70	1.24	1.24								
75	1.28	1.28	0.83	0.83						
90	1.39	1.39	0.90	0.90						
100	1.46	1.46	0.94	0.94						
120	1.61	1.61	1.03	1.03						
140	1.76	1.76	1.12	1.12						
160	1.91	1.91	1.20	1.20	1.04	1.04				
180	2.06	2.06	1.29	1.29	1.11	1.11				
200	2.21	2.21	1.38	1.38	1.18	1.18	0.72	0.68		
250	2.58	2.58	1.59	1.59	1.35	1.35	0.80	0.75		
300	2.96	2.96	1.81	1.81	1.52	1.52	0.87	0.82	0.53	0.50
350	3.33	3.33	2.03	2.03	1.69	1.69	0.94	0.89	0.57	0.53
400	3.37	3.37	2.24	2.24	1.86	1.86	1.02	0.96	0.61	0.57
450			2.46	2.46	2.03	2.03	1.09	1.03	0.65	0.61
500			2.67	2.67	2.20	2.20	1.16	1.10	0.69	0.65
550					2.37	2.37	1.24	1.16	0.73	0.69
600					2.54	2.54	1.31	1.23	0.77	0.72
700					2.59	2.59	1.34	1.34	0.85	0.80

Basic performance data (cont.)

RESISTANCE TO TENSION AND SHEAR LOADS UNDER FIRE EXPOSURE - STANDARD EMBEDMENT DEPTH

Size			M8	M10	M12	M16	M20
Effective embedment depth	h_{ef}	[mm]	47	59	68	85	99
R (for EI) = 30 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s,fi=30}$	[kN]	0.40	0.90	1.70	3.10	4.90
PULL-OUT FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,p,fi=30}$	[kN]	1.30	2.30	3.00	5.00	-
CONCRETE CONE FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,c,fi=30}$	[kN]	2.70	4.80	6.90	12.00	17.60
SHEAR LOAD							
CONCRETE PRY-OUT FAILURE							
	k	-	1	1	2	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	1.30	2.30	6.00	10.00	-
STEEL FAILURE							
Characteristic resistance	$V_{Rk,s,fi=30}$	[kN]	0.40	0.90	1.70	3.10	4.90
R (for EI) = 60 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s,fi=60}$	[kN]	0.30	0.80	1.30	2.40	3.70
PULL-OUT FAILURE							
Characteristic resistance	$N_{Rk,p,fi=60}$	[kN]	1.30	2.30	3.00	5.00	-
CONCRETE CONE FAILURE							
Characteristic resistance	$N_{Rk,c,fi=60}$	[kN]	2.70	4.80	6.90	12.00	17.60
SHEAR LOAD							
CONCRETE PRY-OUT FAILURE							
	k	-	1	1	2	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	1.30	2.30	6.00	10.00	-
STEEL FAILURE							
Characteristic resistance	$V_{Rk,s,fi=60}$	[kN]	0.30	0.80	1.30	2.40	3.70
R (for EI) = 90 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s,fi=90}$	[kN]	0.30	0.60	1.10	2.00	3.20
PULL-OUT FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,p,fi=90}$	[kN]	1.30	2.30	3.00	5.00	-
CONCRETE CONE FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,c,fi=90}$	[kN]	2.70	4.80	6.90	12.00	17.60
SHEAR LOAD							
CONCRETE PRY-OUT FAILURE							
	k	-	1	1	2	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	1.30	2.30	6.00	10.00	-
STEEL FAILURE							
Characteristic resistance	$V_{Rk,s,fi=90}$	[kN]	0.30	0.60	1.10	2.00	3.20
R (for EI) = 120 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s,fi=120}$	[kN]	0.20	0.50	0.80	1.60	2.50
PULL-OUT FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,p,fi=120}$	[kN]	1.00	1.80	2.40	4.00	-
CONCRETE CONE FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,c,fi=120}$	[kN]	2.00	2.50	5.90	9.60	14.40
SHEAR LOAD							
CONCRETE PRY-OUT FAILURE							
	k	-	1	1	2	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	1.00	1.80	4.80	8.00	-
STEEL FAILURE							
Characteristic resistance	$V_{Rk,s,fi=120}$	[kN]	0.20	0.50	0.80	1.60	2.50

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Basic performance data (cont.)

RESISTANCE TO TENSION AND SHEAR LOADS UNDER FIRE EXPOSURE - STANDARD EMBEDMENT DEPTH

Size			M8	M10	M12	M16	M20
Effective embedment depth	h_{ef}	[mm]	32	39	48	65	80
R (For EI) = 30 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s, Fi=30}$	[kN]	0.40	0.90	1.70	3.10	4.90
PULL-OUT FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,p, Fi=30}$	[kN]	0.80	1.50	2.30	4.00	-
CONCRETE CONE FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,c, Fi=30}$	[kN]	1.00	1.70	2.90	6.10	10.30
SHEAR LOAD							
CONCRETE PRY-OUT FAILURE							
	k	-	1	1	1	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	0.80	1.50	2.30	8.00	-
STEEL FAILURE							
Characteristic resistance	$V_{Rk,s, Fi=30}$	[kN]	0.40	0.90	1.70	3.10	4.90
R (For EI) = 60 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s, Fi=60}$	[kN]	0.30	0.80	1.30	2.40	3.70
PULL-OUT FAILURE							
Characteristic resistance	$N_{Rk,p, Fi=60}$	[kN]	0.80	1.50	2.30	4.00	-
CONCRETE CONE FAILURE							
Characteristic resistance	$N_{Rk,c, Fi=60}$	[kN]	1.00	1.70	2.90	6.10	10.30
SHEAR LOAD							
CONCRETE PRY-OUT FAILURE							
	k	-	1	1	1	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	0.80	1.50	2.30	8.00	-
STEEL FAILURE							
Characteristic resistance	$V_{Rk,s, Fi=60}$	[kN]	0.30	0.80	1.30	2.40	3.70
R (For EI) = 90 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s, Fi=90}$	[kN]	0.30	0.60	1.10	2.00	3.20
PULL-OUT FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,p, Fi=90}$	[kN]	0.80	1.50	2.30	4.00	-
CONCRETE CONE FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,c, Fi=90}$	[kN]	1.00	1.70	2.90	6.10	10.30
SHEAR LOAD							
CONCRETE PRY-OUT FAILURE							
	k	-	1	1	1	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	0.80	1.50	2.30	8.00	-
STEEL FAILURE							
Characteristic resistance	$V_{Rk,s, Fi=90}$	[kN]	0.30	0.60	1.10	2.00	3.20
R (For EI) = 120 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s, Fi=120}$	[kN]	0.20	0.50	0.80	1.60	2.50
PULL-OUT FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,p, Fi=120}$	[kN]	0.60	1.20	1.80	3.20	-
CONCRETE CONE FAILURE, CONCRETE C20/25 – C50/60							
Characteristic resistance	$N_{Rk,c, Fi=120}$	[kN]	0.90	1.10	3.20	6.10	10.30
SHEAR LOAD							
CONCRETE PRY-OUT FAILURE							
	k	-	1	1	1	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	0.60	1.20	1.80	6.40	-
STEEL FAILURE							
Characteristic resistance	$V_{Rk,s, Fi=120}$	[kN]	0.20	0.50	0.80	1.60	2.50