R-HPTII-ZF ZINC FLAKE THROUGHBOLT

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

Approvals and reports

- ETA-12/0309

CE ETA

Product information

Features and benefits

- High performance in cracked and non-cracked concrete confirmed by ETA Option 1
- Corrosion-resistant protection (1000h in Neutral Salt Spray test)
- Embedment depth markings help to ensure precise installation
- R-HPTII-ZF is suitable for reduced embedment to avoid contact with reinforcement
- Head marking helps to determine anchor length and setting depth after installation
- Optimized expander design with six grip features allows for a high load-bearing capacity
- Cold formed body ensures consistent dimensional accuracy

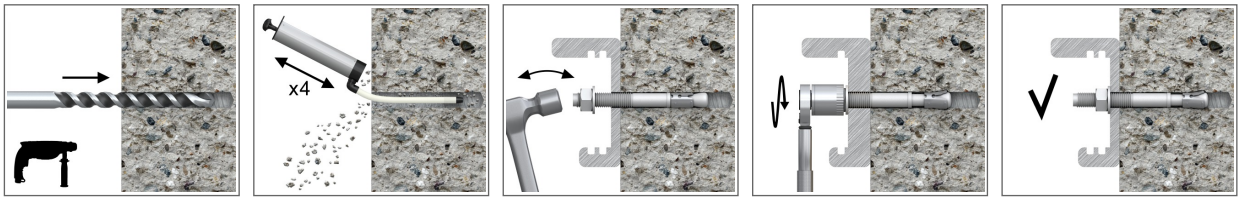
Applications

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

Base material

- Cracked concrete, class C20/25-C50/60
- Non-cracked concrete C20/25-C50/60
- Concrete

Installation guide



1. Drill a hole of required diameter and depth
2. Remove debris and thoroughly clean hole with brush and pump
3. Lightly tap the throughbolt through the fixture into hole with a hammer, until fixing depth is reached
4. Tighten to the recommended torque

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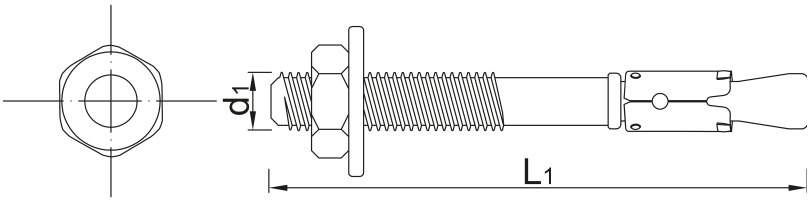
Product information



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

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
STANDARD EMBEDMENT DEPTH							
Min. hole depth in substrate	$h_{0,s}$	[mm]	55	69	80	100	119
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 (Cracked concrete)	$c_{min,r}$	[mm]	40	45	65	90	100
Min. edge distance (Non-cracked concrete)	$c_{min,r}$	[mm]	40	50	65	100	120

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Installation data

Size			M8	M10	M12	M16	M20
REDUCED EMBEDMENT DEPTH							
Min. hole depth in substrate	$h_{0,r}$	[mm]	40	49	60	80	100
Installation depth	$h_{nom,r}$	[mm]	40	49	60	80	100
Min. substrate thickness	$h_{min,r}$	[mm]	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 - tension	f_{uk}	[N/mm²]	620	620	620	620	620
Nominal ultimate tensile strength - shear	f_{uk}	[N/mm²]	520	520	520	520	520
Nominal yield strength - tension	f_{yk}	[N/mm²]	531	531	531	531	531
Nominal yield strength - shear	f_{yk}	[N/mm²]	416	416	416	416	416
Cross sectional area - tension	A_s	[mm²]	25.5	40.7	60.1	106.6	162.9
Cross sectional area - shear	A_s	[mm²]	38.9	61.7	89.6	165.2	259.1
Elastic section modulus	W_{el}	[mm³]	34.3	68.3	119.6	299.5	588.3
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	19	38	67	167	328
Design bending resistance	M	[Nm]	15	31	53	134	263

Basic performance data

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

Size		M8	M10	M12	M16	M20
CRACKED CONCRETE						
Standard embedment depth h_{ef}	[mm]	47	59	68	85	99
Reduced embedment depth h_{ef}	[mm]	32	39	48	65	80
NON-CRACKED CONCRETE						
Reduced embedment depth h_{ef}	[mm]	32	39	48	65	80
Standard embedment depth h_{ef}	[mm]	47	59	68	85	99

R-HPTII-ZF ZINC FLAKE THROUGHBOLT

Basic performance data

Size		M8	M10	M12	M16	M20
MEAN ULTIMATE LOAD						
TENSION LOAD $N_{Ru,m}$						
CRACKED CONCRETE						
Standard embedment depth	[kN]	7.5	12.5	19.9	27.3	41.9
Reduced embedment depth	[kN]	4.8	8.6	12.8	26.8	32.7
NON-CRACKED CONCRETE						
Reduced embedment depth	[kN]	9.6	13.6	17.6	34.5	47.1
Standard embedment depth	[kN]	12.4	20.6	27.7	45.5	64.8
SHEAR LOAD $V_{Ru,m}$						
CRACKED CONCRETE						
Standard embedment depth	[kN]	12.2	19.2	28	51.5	80.9
Reduced embedment depth	[kN]	12.2	19.2	28	51.5	80.9
NON-CRACKED CONCRETE						
Reduced embedment depth	[kN]	12.2	19.2	28	51.5	80.9
Standard embedment depth	[kN]	12.2	19.2	28	51.5	80.9
CHARACTERISTIC LOAD						
TENSION LOAD N_{Rk}						
CRACKED CONCRETE						
Standard embedment depth	[kN]	5	9	12	20	30
Reduced embedment depth	[kN]	3	6	9	16	25.8
NON-CRACKED CONCRETE						
Reduced embedment depth	[kN]	7.5	9	12	26.4	36.1
Standard embedment depth	[kN]	9	12	20	35	49.6
SHEAR LOAD V_{Rk}						
CRACKED CONCRETE						
Standard embedment depth	[kN]	5	9	23.3	40	60
Reduced embedment depth	[kN]	3	6	9	32	51.6
NON-CRACKED CONCRETE						
Reduced embedment depth	[kN]	7.5	9	12	43	67.4
Standard embedment depth	[kN]	9	12	23.3	43	67.4
DESIGN LOAD						
TENSION LOAD N_{Rd}						
CRACKED CONCRETE						
Standard embedment depth	[kN]	2.78	6	8	13.3	20
Reduced embedment depth	[kN]	1.67	3.33	6	10.7	17.2
NON-CRACKED CONCRETE						
Reduced embedment depth	[kN]	4.17	5	8	17.6	24.1
Standard embedment depth	[kN]	5	8	13.3	23.3	33.1
SHEAR LOAD V_{Rd}						
CRACKED CONCRETE						
Standard embedment depth	[kN]	2.78	6	16	26.7	40
Reduced embedment depth	[kN]	1.67	3.33	6	21.3	34.5
NON-CRACKED CONCRETE						
Reduced embedment depth	[kN]	4.17	5	8	34.4	48.1
Standard embedment depth	[kN]	5	8	18.6	34.4	53.9

R-HPTII-ZF ZINC FLAKE THROUGHBOLT

Basic performance data

Size		M8	M10	M12	M16	M20
RECOMMENDED LOAD						
TENSION LOAD N_{rec}						
CRACKED CONCRETE						
Standard embedment depth	[kN]	1.98	4.29	5.71	9.52	14.3
Reduced embedment depth	[kN]	1.19	2.38	4.29	7.62	12.3
NON-CRACKED CONCRETE						
Reduced embedment depth	[kN]	2.98	3.57	5.71	12.6	17.2
Standard embedment depth	[kN]	3.57	5.71	9.52	16.7	23.6
SHEAR LOAD V_{rec}						
CRACKED CONCRETE						
Standard embedment depth	[kN]	1.99	4.29	11.4	19.1	28.6
Reduced embedment depth	[kN]	1.19	2.38	4.29	15.2	24.6
NON-CRACKED CONCRETE						
Reduced embedment depth	[kN]	2.98	3.57	5.71	24.6	34.4
Standard embedment depth	[kN]	3.57	5.71	13.3	24.6	38.5

Design performance data

Reduced embedment depth

Size			M8	M10	M12	M16	M20
Embedment depth	h_{ef}	[mm]	32	39	48	65	80
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s}$	[kN]	15.8	25.2	37.3	66.1	101
Design resistance γ_{Ms}= 1.4	$N_{Rd,s}$	[kN]	11.3	18	26.6	47.2	72.1
PULL-OUT FAILURE; NON-CRACKED CONCRETE C20/25							
Characteristic resistance	$N_{Rk,p}$	[kN]	7.5	9	12	-	-
Design resistance γMp= 1.8	$N_{Rd,p}$	[kN]	4.17	-	-	-	-
Design resistance γMp= 1.5	$N_{Rd,p}$	[kN]	-	5	8	-	-
PULL-OUT FAILURE; CRACKED CONCRETE C20/25							
Characteristic resistance	$N_{Rk,p}$	[kN]	3	6	9	16	-
Design resistance γMp= 1.8	$N_{Rd,p}$	[kN]	1.67	-	-	-	-
Design resistance γMp= 1.5	$N_{Rd,p}$	[kN]	-	3.33	6	10.7	-
CONCRETE CONE FAILURE; CRACKED CONCRETE C20/25							
Characteristic resistance	$N_{Rk,c}$	-		-	-	-	25.8
Design resistance γ_{Mc}= 1.5	$N_{Rd,c}$	-		-	-	-	17.2
CONCRETE CONE FAILURE; NON-CRACKED CONCRETE C20/25							
Characteristic resistance	$N_{Rk,c}$	-		-	-	26.4	36.1
Design resistance γ_{Mc}= 1.5	$N_{Rd,c}$	-		-	-	17.6	24.1
Increasing factors for NRd,p - C30/37	Ψ_c	-	1.2	1.16	1.22	1.11	1.12
Increasing factors for NRd,p - C40/50	Ψ_c	-	1.4	1.33	1.44	1.22	1.26
Increasing factors for NRd,p - C50/60	Ψ_c	-	1.6	1.5	1.67	1.33	1.39
Spacing	$s_{cr,N}$	[mm]	96	117	144	195	240
Edge distance	$c_{cr,N}$	[mm]	48	59	72	98	120

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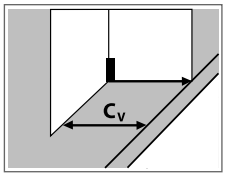
Design performance data

SHEAR LOAD							
CONCRETE EDGE FAILURE; NON-CRACKED CONCRETE C20/25							
Edge distance	c_1	[mm]	45	60	100	125	200
Characteristic resistance for c_1	$V_{Rk,c}$	[kN]	5.52	8.67	18.4	27	54.1
Design resistance γ_{Mc}= 1.8	$V_{Rd,c}$	[kN]	3.07	-	-	-	-
Design resistance γ_{Mc}= 1.5	$V_{Rd,c}$	[kN]	-	4.82	12.2	18	36.1
CONCRETE EDGE FAILURE; CRACKED CONCRETE C20/25							
Edge distance	c_1	[mm]	40	50	80	110	120
Characteristic resistance for c_1	$V_{Rk,c}$	[kN]	3.33	4.8	9.61	16.1	19.4
Design resistance γ_{Mc}= 1.8	$V_{Rd,c}$	[kN]	1.85	-	-	-	-
Design resistance γ_{Mc}= 1.5	$V_{Rd,c}$	[kN]	-	2.67	6.41	10.8	12.9
CONCRETE PRY-OUT FAILURE; NON-CRACKED CONCRETE C20/25							
	k	-	1	1	1	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	7.5	9	12	52.8	72.2
Design resistance γ_{Mc}= 1.8	$V_{Rd,cp}$	[kN]	4.17	-	-	-	-
Design resistance γ_{Mc}= 1.5	$V_{Rd,cp}$	[kN]	-	5	8	35.2	48.1
CONCRETE PRY-OUT FAILURE; CRACKED CONCRETE C20/25							
	k	-	1	1	1	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	3	6	9	32	51.6
Design resistance γ_{Mc}= 1.8	$V_{Rd,cp}$	[kN]	1.67	-	-	-	-
Design resistance γ_{Mc}= 1.5	$V_{Rd,cp}$	[kN]	-	3.33	6	21.3	34.4
STEEL FAILURE							
Characteristic resistance without lever	$V_{Rk,s}$	[kN]	10.1	16	23.3	43	67.4
Design resistance γ_{Ms}= 1.25	$V_{Rd,s}$	[kN]	8.08	12.8	18.6	34.4	53.9

Reduction / increasing resistance factors for edge distance and spacing

EDGE DISTANCE (SHEAR)



Tables only valid for one edge >c_{min} and s ≥ 3c_v For other cases use the Rawlplug Anchor Calculator

Increasing factors for edge distance >c_{min} applicable to $V_{Rd,c}$ for non-cracked concrete from 'Design Performance' table

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	1,00	1,00								
50	1,15	1,15								
55	1,32	1,32								
60			1,00	1,00						
100					0,65	0,65				
125							1,00	0,83		
150							1,28	0,97		
200							1,89	1,25	1,00	0,73
220								1,35	1,14	0,79
247								1,50	1,33	0,87
280								1,67		0,98
320								1,89		1,10
380										1,27
400										1,33

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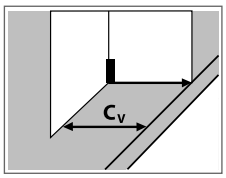
Design performance data

EDGE DISTANCE (SHEAR)



Tables only valid for one edge $>c_{min}$ and $s \geq 3c_v$ For other cases use the Rawlplug Anchor Calculator

Increasing factors for edge distance $>c_{min}$ applicable to $V_{Rd,c}$ for cracked concrete from 'Design Performance' table

c_v [mm]	M8		M10		M12		M16		M20	
	$h \geq 1.5c_v$	h_{min}	$h \geq 1.5c_v$	h_{min}	$h \geq 1.5c_v$	h_{min}	$h \geq 1.5c_v$	h_{min}	$h \geq 1.5c_v$	h_{min}
40	0,90	0,90								
50			1,00	1,00						
55			1,14	1,14						
60			1,14	1,14						
80					0,94	0,94				
110							1,00	0,89		
120							1,12	0,95	1,00	0,94
150							1,52	1,15	1,34	1,13
180							1,95	1,35	1,72	1,32
200								1,48	1,98	1,44
245								1,77	2,60	1,72
270								1,93		1,87
350										2,34
400										2,64

EDGE DISTANCE (TENSION)

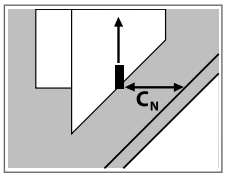


Table only valid for one edge $<C_{cr,N}$ and $S \geq S_{cr,N}$ For other cases use the Rawlplug Anchor Calculator

Reduction factors for edge distance $<C_{cr,N}$ applicable to N_{Rd} or N_{rec} for non-cracked concrete from 'Basic Performance' table

c_N [mm]	M8		M10		M12		M16		M20	
	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}
45	0,95	0,66								
50	1,00	0,70								
60		0,78	1,00	0,70						
70		0,86		0,77						
85		1,00		0,88						
100				1,00	1,00	0,85				
125						1,00	1,00	0,83		
140								0,90		
150								0,95		
160								1,00		
200									1,00	0,98
205										1,00

EDGE DISTANCE (TENSION)

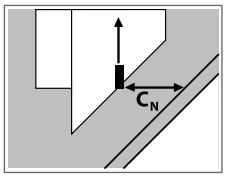


Table only valid for one edge $<C_{cr,N}$ and $S \geq S_{cr,N}$ For other cases use the Rawlplug Anchor Calculator

Reduction factors for edge distance $<C_{cr,N}$ applicable to N_{Rd} or N_{rec} for cracked concrete from 'Basic Performance' table

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Design performance data

c_N [mm]	M8		M10		M12		M16		M20	
	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}
40	0,87	0,62								
45	0,95	0,66								
50	1,00	0,70	0,89	0,64						
60		0,78	1,00	0,70						
80		0,95		0,85	1,00	0,73				
85		1,00		0,88		0,76				
100				1,00		0,85				
110						0,91	1,00	0,76		
120						0,97		0,81	1,00	0,69
125						1,00		0,83		0,71
160								1,00		0,83
180										0,90
200										0,98
205										1,00

SPACING

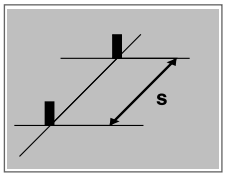

Table only valid for one spacing $<s_{cr,N}$ and $c \geq c_{cr,N}$ For other cases use the Rawlplug Anchor Calculator

Reduction factors for spacing $<s_{cr,N}$ applicable to N_{Rd} / V_{Rd} or N_{rec} / V_{rec} for non-cracked concrete from 'Basic Performance' table

C_N [mm]	M8		M10		M12		M16		M20	
	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}
55	0,79	0,66								
65	0,84	0,69								
75	0,89	0,72	0,82	0,69						
85	0,94	0,75	0,86	0,71						
95	1,00	0,78	0,91	0,74						
100		0,79	0,93	0,75						
120		0,85	1,00	0,80						
140		0,91		0,85						
150		0,94		0,88	1,00	0,80				
170		1,00		0,93		0,84				
190				0,98		0,88	0,99	0,80		
195				0,99		0,89	1,00	0,80		
200				1,00		0,90		0,81		
250						1,00		0,89		
300								0,97	1,00	0,87
320								1,00		0,89
380										0,96
410										1,00

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Design performance data

SPACING

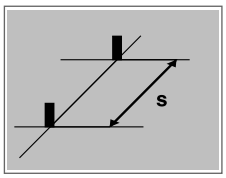


Table only valid for one spacing $<s_{cr,N}$ and $c \geq c_{cr,N}$. For other cases use the Rawlplug Anchor Calculator

Reduction factors for spacing $<s_{cr,N}$ applicable to N_{Rd} / V_{Rd} or N_{rec} / V_{rec} for cracked concrete from 'Basic Performance' table

C_N	M8		M10		M12		M16		M20	
[mm]	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}
55	0,79	0,66								
75	0,89	0,72	0,82	0,69						
80	0,92	0,74	0,84	0,70						
95	1,00	0,78	0,91	0,74						
100		0,79	0,93	0,75						
120		0,85	1,00	0,80						
150		0,94		0,88	1,00	0,80				
170		1,00		0,93		0,84				
180				0,95		0,86				
190				0,98		0,88	0,99	0,80		
195				0,99		0,89	1,00	0,80		
200				1,00		0,90		0,81		
250						1,00		0,89		
260								0,91		
280								0,94		
300								0,97	1,00	0,87
320								1,00		0,89
410										1,00

R-HPTII-ZF ZINC FLAKE THROUGHBOLT

Design performance data

Resistance to tension and shear loads under fire exposure - Reduced embedment depth

Size			M8	M10	M12	M16	M20
R (for EI) = 30 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s}$	[kN]	0.4	0.9	1.7	3.1	4.9
PULL-OUT FAILURE							
Characteristic resistance	$N_{Rk,p}$	[kN]	0.8	1.5	2.3	4	-
CONCRETE CONE FAILURE							
Characteristic resistance	$N_{Rk,c}$	[kN]	1	1.7	2.9	6.1	10.3
SHEAR LOAD							
STEEL FAILURE							
Characteristic resistance without lever	$V_{Rk,s}$	[kN]	0.4	0.9	1.7	3.1	4.9
Characteristic resistance with lever arm	$M^{Rk,s}$	[kN]	0.4	1.1	2.6	6.7	13
R (for EI) = 60 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s}$	[kN]	0.3	0.8	1.3	2.4	3.7
PULL-OUT FAILURE							
Characteristic resistance	$N_{Rk,p}$	[kN]	0.8	1.5	2.3	4	-
CONCRETE CONE FAILURE							
Characteristic resistance	$N_{Rk,c}$	[kN]	1	1.7	2.9	6.1	10.3
SHEAR LOAD							
STEEL FAILURE							
Characteristic resistance without lever	$V_{Rk,s}$	[kN]	0.3	0.8	1.3	2.4	3.7
Characteristic resistance with lever arm	$M^{Rk,s}$	[kN]	0.3	1	2	5	9.7
R (for EI) = 90 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s}$	[kN]	0.3	0.6	1.1	2	3.2
PULL-OUT FAILURE							
Characteristic resistance	$N_{Rk,p}$	[kN]	0.8	1.5	2.3	4	-
CONCRETE CONE FAILURE							
Characteristic resistance	$N_{Rk,c}$	[kN]	1	1.7	2.9	6.1	10.3
SHEAR LOAD							
STEEL FAILURE							
Characteristic resistance without lever	$V_{Rk,s}$	[kN]	0.3	0.6	1.1	2	3.2
Characteristic resistance with lever arm	$M^{Rk,s}$	[kN]	0.3	0.7	1.7	4.3	8.4
R (for EI) = 120 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s}$	[kN]	0.2	0.5	0.8	1.6	2.5
PULL-OUT FAILURE							
Characteristic resistance	$N_{Rk,p}$	[kN]	0.6	1.2	1.8	3.2	-
CONCRETE CONE FAILURE							
Characteristic resistance	$N_{Rk,c}$	[kN]	0.8	1.4	2.3	4.9	8.2

R-HPTII-ZF ZINC FLAKE THROUGHBOLT

Design performance data

SHEAR LOAD							
STEEL FAILURE							
Characteristic resistance without lever	$V_{Rk,s}$	[kN]	0.2	0.5	0.8	1.6	2.5
Characteristic resistance with lever arm	$M^{Rk,s}$	[kN]	0.2	0.6	1.3	3.3	6.5

Standard embedment depth

Size			**M8**	**M10**	**M12**	**M16**	**M20**
Embedment depth	h_{ef}	[mm]	47	59	68	85	99
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s}$	[kN]	15.8	25.2	37.3	66.1	101
Design resistance γ_{Ms}= 1.4	$N_{Rd,s}$	[kN]	11.3	18	26.6	47.2	72.1
PULL-OUT FAILURE; NON-CRACKED CONCRETE C20/25							
Characteristic resistance	$N_{Rk,p}$	[kN]	9	12	20	35	-
Design resistance γMp= 1.8	$N_{Rd,p}$	[kN]	5	-	-	-	-
Design resistance γMp= 1.5	$N_{Rd,p}$	[kN]	-	8	13.3	23.3	-
PULL-OUT FAILURE; CRACKED CONCRETE C20/25							
Characteristic resistance	$N_{Rk,p}$	[kN]	5	9	12	20	30
Design resistance γMp= 1.8	$N_{Rd,p}$	[kN]	2.78	-	-	-	-
Design resistance γMp= 1.5	$N_{Rd,p}$	[kN]	-	6	8	13.3	20
CONCRETE CONE FAILURE; NON-CRACKED CONCRETE C20/25							
Characteristic resistance	$N_{Rk,c}$	-		-	-	-	49.6
Design resistance γ_{Mc}= 1.5	$N_{Rd,c}$	-		-	-	-	33.1
Increasing factors for NRd,p - C30/37	Ψ_c	-	1.12	1.22	1	1.14	1.07
Increasing factors for NRd,p - C40/50	Ψ_c	-	1.22	1.44	1	1.28	1.14
Increasing factors for NRd,p - C50/60	Ψ_c	-	1.33	1.67	1	1.43	1.21
Spacing	$s_{cr,N}$	[mm]	141	177	204	255	297
Edge distance	$c_{cr,N}$	[mm]	71	89	102	128	149

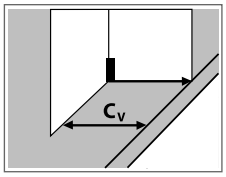
R-HPTII-ZF ZINC FLAKE THROUGHBOLT

Design performance data

SHEAR LOAD							
CONCRETE EDGE FAILURE; NON-CRACKED CONCRETE C20/25							
Edge distance	c_1	[mm]	40	50	65	100	120
Characteristic resistance for c_1	$V_{Rk,c}$	[kN]	5.03	7.32	11	21.1	28.6
Design resistance γ_{Mc}= 1.8	$V_{Rd,c}$	[kN]	2.79	-	-	-	-
Design resistance γ_{Mc}= 1.5	$V_{Rd,c}$	[kN]	-	4.88	7.3	14.1	19
CONCRETE EDGE FAILURE; CRACKED CONCRETE C20/25							
Edge distance	c_1	[mm]	40	45	65	90	100
Characteristic resistance for c_1	$V_{Rk,c}$	[kN]	3.56	4.52	7.76	13	16
Design resistance γ_{Mc}= 1.8	$V_{Rd,c}$	[kN]	1.98	-	-	-	-
Design resistance γ_{Mc}= 1.5	$V_{Rd,c}$	[kN]	-	3.01	5.17	8.68	10.7
CONCRETE PRY-OUT FAILURE; NON-CRACKED CONCRETE C20/25							
	k	-	1	1	2	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	9	12	40	70	99.2
Design resistance γ_{Mc}= 1.8	$V_{Rd,cp}$	[kN]	5	-	-	-	-
Design resistance γ_{Mc}= 1.5	$V_{Rd,cp}$	[kN]	-	8	26.7	46.7	66.1
CONCRETE PRY-OUT FAILURE; CRACKED CONCRETE C20/25							
	k	-	1	1	2	2	2
Characteristic resistance	$V_{Rk,cp}$	[kN]	5	9	24	40	60
Design resistance γ_{Mc}= 1.8	$V_{Rd,cp}$	[kN]	2.78	-	-	-	-
Design resistance γ_{Mc}= 1.5	$V_{Rd,cp}$	[kN]	-	6	16	26.7	40
STEEL FAILURE							
Characteristic resistance without lever	$V_{Rk,s}$	[kN]	10.1	16	23.3	43	67.4
Design resistance γ_{Ms}= 1.25	$V_{Rd,s}$	[kN]	8.08	12.8	18.6	34.4	53.9

Reduction / increasing resistance factors for edge distance and spacing

EDGE DISTANCE (SHEAR)



Tables only valid for one edge >c_{min} and s ≥ 3c_v For other cases use the Rawlplug Anchor Calculator

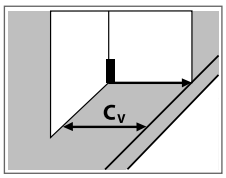
Increasing factors for edge distance >c_{min} applicable to $V_{Rd,c}$ for non-cracked concrete from 'Design Performance' table

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	1,00	1,00								
50	1,35	1,35	1,00	1,00						
60	1,58	1,58	1,24	1,24						
65	1,68	1,68	1,31	1,31	1,00	1,00				
70	1,72	1,72	1,38	1,38	1,10	1,10				
80			1,52	1,52	1,32	1,32				
88			1,56	1,56	1,49	1,49				
100					1,77	1,71	1,00	1,00		
120					2,27	2,00	1,27	1,24	1,00	1,00
130					2,53	2,14	1,41	1,32	1,11	1,11
158						2,53	1,83	1,55	1,43	1,32
195							2,44	1,86	1,90	1,57
260								2,38	2,79	2,00
265								2,42		2,03
340										2,52
385										2,81

R-HPTII-ZF ZINC FLAKE THROUGHBOLT

Design performance data

EDGE DISTANCE (SHEAR)



Tables only valid for one edge $>c_{min}$ and $s \geq 3c_v$ For other cases use the Rawlplug Anchor Calculator

Increasing factors for edge distance $>c_{min}$ applicable to $V_{Rd,c}$ for cracked concrete from 'Design Performance' table

c_v [mm]	M8		M10		M12		M16		M20	
	$h \geq 1.5c_v$	h_{min}	$h \geq 1.5c_v$	h_{min}	$h \geq 1.5c_v$	h_{min}	$h \geq 1.5c_v$	h_{min}	$h \geq 1.5c_v$	h_{min}
40	0,96	0,96								
45	1,03	1,03	1,00	1,00						
50	1,10	1,10	1,15	1,15						
65	1,32	1,32	1,59	1,59	1,00	1,00				
70	1,35	1,35	1,67	1,67	1,10	1,10				
75			1,76	1,76	1,21	1,21				
80			1,84	1,84	1,32	1,32				
90			1,97	1,97	1,54	1,54	1,00	1,00		
100					1,77	1,71	1,15	1,15	1,00	1,00
130					2,53	2,14	1,62	1,52	1,40	1,40
150					3,07	2,42	1,96	1,71	1,69	1,60
195						3,04	2,80	2,13	2,40	1,98
210							3,09	2,27	2,65	2,11
270								2,82	3,72	2,61
295								3,05		2,82
410										3,75

EDGE DISTANCE (TENSION)

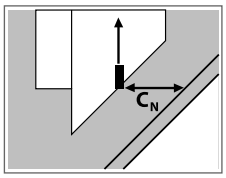


Table only valid for one edge $<C_{cr,N}$ and $S \geq S_{cr,N}$ For other cases use the Rawlplug Anchor Calculator

Reduction factors for edge distance <Ccr,N applicable to NRd or Nrec for non-cracked concrete from 'Basic Performance' table

c_N [mm]	M8		M10		M12		M16		M20	
	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}
40	0,68	0,55								
50	0,78	0,61	0,68	0,53						
65	0,94	0,70	0,80	0,59	0,73	0,56				
70	1,00	0,73	0,84	0,62	0,76	0,58				
80		0,79	0,92	0,66	0,83	0,62				
90		0,86	1,00	0,70	0,91	0,66				
100		0,93		0,75	0,98	0,70	0,83	0,62		
105		0,96		0,77	1,00	0,72	0,86	0,63		
110		1,00		0,80		0,74	0,89	0,65		
120				0,85		0,78	0,95	0,68	0,85	0,61
130				0,90		0,82	1,00	0,71	0,90	0,63
150				1,00		0,91		0,77	1,00	0,68
170						1,00		0,84		0,73
215								1,00		0,85
265										1,00

R-HPTII-ZF ZINC FLAKE THROUGHBOLT

Design performance data

EDGE DISTANCE (TENSION)

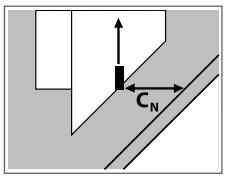


Table only valid for one edge $<C_{cr,N}$ and $S \geq S_{cr,N}$ For other cases use the Rawlplug Anchor Calculator

Reduction factors for edge distance $<C_{cr,N}$ applicable to N_{Rd} or N_{rec} for cracked concrete from 'Basic Performance' table

c_N [mm]	M8		M10		M12		M16		M20	
	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}
40	0,68	0,55								
45	0,73	0,58	0,64	0,51						
50	0,78	0,61	0,68	0,53						
65	0,94	0,70	0,80	0,59	0,73	0,56				
70	1,00	0,73	0,84	0,62	0,76	0,58				
80		0,79	0,92	0,66	0,83	0,62				
90		0,86	1,00	0,70	0,91	0,66	0,78	0,59		
100		0,93		0,75	1,00	0,70	0,83	0,62	0,76	0,56
110		1,00		0,80		0,74	0,89	0,65	0,80	0,58
130				0,90		0,82	1,00	0,71	0,90	0,63
150				1,00		0,91		0,77	1,00	0,68
170						1,00		0,84		0,73
215								1,00		0,85
240										0,93
265										1,00

SPACING

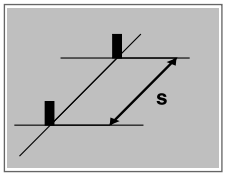


Table only valid for one spacing $<s_{cr,N}$ and $c \geq c_{cr,N}$ For other cases use the Rawlplug Anchor Calculator

Reduction factors for spacing $<s_{cr,N}$ applicable to N_{Rd} / V_{Rd} or N_{rec} / V_{rec} for non-cracked concrete from 'Basic Performance' table

C_N [mm]	M8		M10		M12		M16		M20	
	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}
50	0,68	0,61								
70	0,75	0,66	0,70	0,62						
90	0,82	0,70	0,75	0,65	0,72	0,63				
100	0,85	0,73	0,78	0,67	0,75	0,65				
110	0,89	0,75	0,81	0,68	0,77	0,66				
140	1,00	0,82	0,90	0,73	0,84	0,71				
160		0,86	0,95	0,77	0,89	0,74	0,81	0,69		
180		0,91	1,00	0,80	0,94	0,76	0,85	0,71	0,80	0,67
205		0,97		0,84	1,00	0,80	0,90	0,74	0,85	0,69
220		1,00		0,87		0,82	0,93	0,76	0,87	0,71
225				0,88		0,83	0,94	0,76	0,88	0,71
240				0,90		0,85	0,97	0,78	0,90	0,73
255				0,93		0,88	1,00	0,80	0,93	0,74
300				1,00		0,94		0,85	1,00	0,78
340						1,00		0,90		0,82
380								0,94		0,86
430								1,00		0,91
530										1,00

R-HPTII-ZF ZINC FLAKE THROUGHBOLT

Design performance data

SPACING

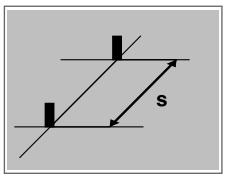


Table only valid for one spacing $<s_{cr,N}$ and $c \geq c_{cr,N}$ For other cases use the Rawlplug Anchor Calculator

Reduction factors for spacing $<s_{cr,N}$ applicable to N_{Rd} / V_{Rd} or N_{rec} / V_{rec} for cracked concrete from 'Basic Performance' table

C_N	M8		M10		M12		M16		M20	
[mm]	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}	$h \geq 1.84h_{min}$	h_{min}
50	0,68	0,61								
70	0,75	0,66	0,70	0,62						
80	0,78	0,68	0,73	0,63						
90	0,82	0,70	0,75	0,65	0,72	0,63				
100	0,85	0,73	0,78	0,67	0,75	0,65				
140	1,00	0,82	0,90	0,73	0,84	0,71				
150		0,84	0,92	0,75	0,87	0,72				
160		0,86	0,95	0,77	0,89	0,74	0,81	0,69		
180		0,91	1,00	0,80	0,94	0,76	0,85	0,71	0,80	0,67
205		0,97		0,84	1,00	0,80	0,90	0,74	0,85	0,69
220		1,00		0,87		0,82	0,93	0,76	0,87	0,71
240				0,90		0,85	0,97	0,78	0,90	0,73
255				0,93		0,88	1,00	0,80	0,93	0,74
300				1,00		0,94		0,85	1,00	0,78
340						1,00		0,90		0,82
400								0,97		0,88
430								1,00		0,91
530										1,00

R-HPTII-ZF ZINC FLAKE THROUGHBOLT

Design performance data

Resistance to tension and shear loads under fire exposure - Standard embedment depth

Size			M8	M10	M12	M16	M20
R (for EI) = 30 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s}$	[kN]	0.4	0.9	1.7	3.1	4.9
PULL-OUT FAILURE							
Characteristic resistance	$N_{Rk,p}$	[kN]	1.3	2.3	3	5	-
CONCRETE CONE FAILURE							
Characteristic resistance	$N_{Rk,c}$	[kN]	2.7	4.8	6.9	12	17.6
SHEAR LOAD							
STEEL FAILURE							
Characteristic resistance without lever	$V_{Rk,s}$	[kN]	0.4	0.9	1.7	3.1	4.9
Characteristic resistance with lever arm	$M^{Rk,s}$	[kN]	0.4	1.1	2.6	6.7	13
R (for EI) = 60 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s}$	[kN]	0.3	0.8	1.3	2.4	3.7
PULL-OUT FAILURE							
Characteristic resistance	$N_{Rk,p}$	[kN]	1.3	2.3	3	5	-
CONCRETE CONE FAILURE							
Characteristic resistance	$N_{Rk,c}$	[kN]	2.7	4.8	6.9	12	17.6
SHEAR LOAD							
STEEL FAILURE							
Characteristic resistance without lever	$V_{Rk,s}$	[kN]	0.3	0.8	1.3	2.4	3.7
Characteristic resistance with lever arm	$M^{Rk,s}$	[kN]	0.3	1	2	5	9.7
R (for EI) = 90 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s}$	[kN]	0.3	0.6	1.1	2	3.2
PULL-OUT FAILURE							
Characteristic resistance	$N_{Rk,p}$	[kN]	1.3	2.3	3	5	-
CONCRETE CONE FAILURE							
Characteristic resistance	$N_{Rk,c}$	[kN]	2.7	4.8	6.9	12	17.6
SHEAR LOAD							
STEEL FAILURE							
Characteristic resistance without lever	$V_{Rk,s}$	[kN]	0.3	0.6	1.1	2	3.2
Characteristic resistance with lever arm	$M^{Rk,s}$	[kN]	0.3	0.7	1.7	4.3	8.4
R (for EI) = 120 min							
TENSION LOAD							
STEEL FAILURE							
Characteristic resistance	$N_{Rk,s}$	[kN]	0.2	0.5	0.8	1.6	2.5
PULL-OUT FAILURE							
Characteristic resistance	$N_{Rk,p}$	[kN]	1	1.8	2.4	4	-
CONCRETE CONE FAILURE							
Characteristic resistance	$N_{Rk,c}$	[kN]	2.2	3.9	5.5	9.6	14

R-HPTII-ZF ZINC FLAKE THROUGHBOLT

Design performance data

SHEAR LOAD							
STEEL FAILURE							
Characteristic resistance without lever	$V_{Rk,s}$	[kN]	0.2	0.5	0.8	1.6	2.5
Characteristic resistance with lever arm	$M_{Rk,s}$	[kN]	0.2	0.6	1.3	3.3	6.5