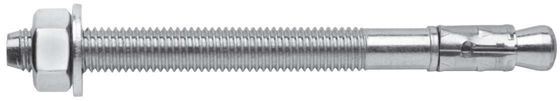
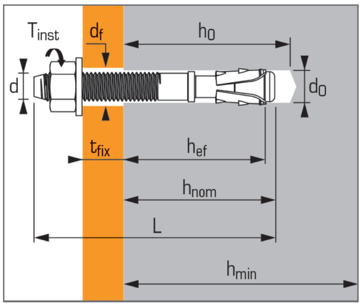


Torque controlled expansion anchor, for use in cracked and non-cracked concrete

ETA European Technical Assessment
ETA Option 1- 15/0388



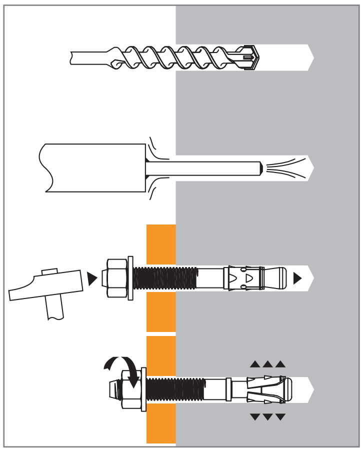
APPLICATION

- Steel and timber framework and beams
- Lift guide rails
- Industrial doors and gates
- Brickwork support angles
- Storage systems

MATERIAL

- **Body :** cold formed steel, DIN 1654, part 2 or 4 / Zinc electroplated Zn5C/Fe (5 µm), NFA 91102
- **Sleeve :** S355 MC as per NF EN 10-149-2
- **Nut :** steel strength grade 6 or 8, ISO 898-2
- **Washer :** steel, NF E 25513

INSTALLATION

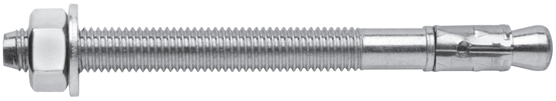


Technical data

Anchor size	Letter marking	Min. anchor depth (mm) h_{ef}	Embed. depth (mm) h_{nom}	Max. thick. of part to be fixed (mm) t_{fix}	Drilling depth (mm) h_0	Min. thick. of base material (mm) h_{min}	Thread diameter (mm) d	Drilling diameter (mm) d_0	Clearance diameter (mm) d_f	Total anchor length (mm) L	Tighten torque (Nm) T_{inst}	Code
8X65/5	B			5						65		057763
8X75/15	D			15						75		057764
8X90/30	E	46	51	30	60	100	8	8	9	90	20	057765
8X120/60	G			60						120		057766
8X130/70	I			70						130		057788
10X85/5	D			5						85		057768
10X90/10	E			10						90		057769
10X100/20	F	60	68	20	75	120	10	10	12	100	45	057770
10X120/40	G			40						120		057771
10X140/60	I			60						140		057772
10X160/80	-			80						160		057773
12X100/5	E			5						100		057774
12X105/10	F			10						105		057775
12X115/20	G	70	80	20	90	140	12	12	14	115	60	057776
12X135/40	I			40						135		057777
12X155/60	J			60						155		057778
12X180/85	L			85						180		057779
16X145/25	I			25						145		057781
16X170/50	K	85	98	50	110	170	16	16	18	170	110	057782
16X180/60	L			60						180		057783
20X170/30	K			30						170		057785
20X200/60	M	100	113	60	130	200	20	20	22	200	160	057786
20X220/80	O			80						220		057787

Anchor mechanical properties

Anchor size		M8	M10	M12	M16	M20
Cross-section above cone						
f_{uk} (N/mm²)	Min. tensile strength	900	830	830	720	600
f_{yk} (N/mm²)	Yield strength	800	670	670	580	580
As (mm²)	Stressed cross-section	22,9	35,3	45,4	88,2	165,1
Threaded part						
f_{uk} (N/mm²)	Min. tensile strength	750	730	730	600	500
f_{yk} (N/mm²)	Yield strength	680	580	580	480	410
As (mm²)	Stressed cross-section	36,6	58	84,3	156	245
W_{el} (mm³)	Elastic section modulus	31,23	62,3	109,17	277,47	540,9
$M^0_{rk,s}$ (Nm)	Characteristic bending moment	21	36	63	133	222
M (Nm)	Recommended bending moment	8,7	14,7	25,8	54,4	90,5



The loads specified on this page allow judging the product's performances, but cannot be used for the designing.
The data given in the pages "CC method" have to be applied (3/6 to 6/6).

Ultimate ($N_{Ru,m}$, $V_{Ru,m}$) and characteristic loads (N_{Rk}, V_{Rk}) in kN

Mean Ultimate loads are derived from test results in admissible service conditions, and characteristic loads are statistically determined.

TENSILE

Anchor size	M8	M10	M12	M16	M20
Non-cracked concrete (C20/25)					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N_{Ru,m}$	15,8	26,1	35,5	47,5	60,1
N_{Rk}	9,1	21,2	29,8	40,3	45,0
Cracked concrete (C20/25)					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N_{Ru,m}$	10,7	16,9	25,7	38,9	60,9
N_{Rk}	6,8	13,8	20,7	28,5	52,2

SHEAR

Anchor size	M8	M10	M12	M16	M20
Cracked & non-cracked concrete (C20/25)					
$V_{Ru,m}$	16,1	19,6	26,6	55,4	85,0
V_{Rk}	14,9	16,6	21,2	46,7	79,2

Design loads (N_{Rd}, V_{Rd}) for one anchor without edge or spacing influence in kN

$$N_{Rd} = \frac{N_{Rk}^{*}}{\gamma_{Mc}}$$

*Derived from test results

$$V_{Rd} = \frac{V_{Rk}^{*}}{\gamma_{Ms}}$$

TENSILE

Anchor size	M8	M10	M12	M16	M20
Non-cracked concrete (C20/25)					
h_{ef}	**46**	**60**	**70**	**85**	**100**
N_{Rd}	6,1	14,1	19,9	26,9	30,0
Cracked concrete (C20/25)					
h_{ef}	**46**	**60**	**70**	**85**	**100**
N_{Rd}	4,5	9,2	13,8	19,0	34,8

$\gamma_{Mc} = 1{,}5$

SHEAR

Anchor size	M8	M10	M12	M16	M20
Cracked & non-cracked concrete (C20/25)					
V_{Rd}	11,9	13,3	16,9	37,4	52,8

$\gamma_{Ms} = 1{,}25$ for M8 to M16 and $\gamma_{Ms} = 1{,}5$ for M20

Recommended loads (N_{rec}, V_{rec}) for one anchor without edge or spacing influence in kN

$$N_{rec} = \frac{N_{Rk}^{*}}{\gamma_M \cdot \gamma_F}$$

*Derived from test results

$$V_{rec} = \frac{V_{Rk}^{*}}{\gamma_M \cdot \gamma_F}$$

TENSILE

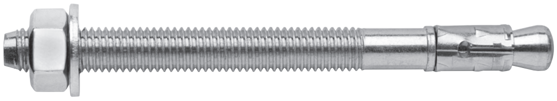
Anchor size	M8	M10	M12	M16	M20
Non-cracked concrete (C20/25)					
h_{ef}	**46**	**60**	**70**	**85**	**100**
N_{rec}	4,3	10,1	14,2	19,2	21,4
Cracked concrete (C20/25)					
h_{ef}	**46**	**60**	**70**	**85**	**100**
N_{rec}	3,5	6,6	9,9	13,6	24,9

$\gamma_{Mc} = 1{,}5$

SHEAR

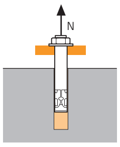
Anchor size	M8	M10	M12	M16	M20
Cracked & non-cracked concrete (C20/25)					
V_{rec}	8,5	9,5	12,1	26,7	37,7

$\gamma_F = 1{,}25$ for M8 to M16 and $\gamma_{Ms} = 1{,}5$ for M20



SPIT CC Method (values issued from ETA)

TENSILE in kN

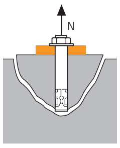


¬ Pull-out resistance

$N_{Rd,p} = N^0_{Rd,p} \cdot f_b$

$N^0_{Rd,p}$					Design pull-out resistance
Anchor size	M8	M10	M12	M16	M20
Non-cracked concrete					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,p}$ (C20/25)	6,0	13,3	20,0	26,7	-
Cracked concrete					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,p}$ (C20/25)	3,3	6,0	10,7	13,3	20,0

$\gamma_{Mc} = 1{,}5$

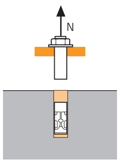


¬ Concrete cone resistance

$N_{Rd,c} = N^0_{Rd,c} \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$

$N^0_{Rd,c}$					Design cone resistance
Anchor size	M8	M10	M12	M16	M20
Non-cracked concrete					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,c}$ (C20/25)	10,5	15,6	19,7	26,3	33,6
Cracked concrete					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,c}$ (C20/25)	7,5	11,2	14,1	18,8	24,0

$\gamma_{Mc} = 1{,}5$

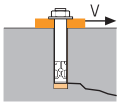


¬ Steel resistance

$N_{Rd,s}$					Steel design tensile resistance
Anchor size	M8	M10	M12	M16	M20
$N_{Rd,s}$	11,3	19,8	25,8	43,7	66,1

$\gamma_{Ms} = 1{,}4$ for M8, $\gamma_{Mc} = 1{,}48$ for M10 to M16 and $\gamma_{Mc} = 1{,}5$ for M20

SHEAR in kN

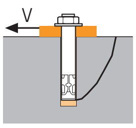


¬ Concrete edge resistance

$V_{Rd,c} = V^0_{Rd,c} \cdot f_b \cdot f_{\beta,V} \cdot \Psi_{S\text{-}C,V}$

$V^0_{Rd,c}$					Design concrete edge resistance at minimum edge distance (C_{min})
Anchor size	M8	M10	M12	M16	M20
Non-cracked concrete					
h_{ef}	**46**	**60**	**70**	**85**	**100**
C_{min}	50	60	60	90	100
S_{min}	75	120	145	140	160
$V^0_{Rd,c}$ (C20/25)	3,0	4,4	4,8	10,0	13,0
Cracked concrete					
h_{ef}	**46**	**60**	**70**	**85**	**100**
C_{min}	50	55	60	80	100
S_{min}	75	90	145	110	130
$V^0_{Rd,c}$ (C20/25)	2,1	2,8	3,4	6,0	9,3

$\gamma_{Mc} = 1{,}5$

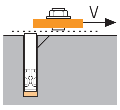


¬ Pryout failure

$V_{Rd,cp} = V^0_{Rd,cp} \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$

$V^0_{Rd,cp}$					Design pryout resistance
Anchor size	M8	M10	M12	M16	M20
Non-cracked concrete					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$V^0_{Rd,cp}$ (C20/25)	10,5	31,2	39,4	52,7	67,2
Cracked concrete					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$V^0_{Rd,cp}$ (C20/25)	7,5	22,3	28,1	37,6	48,0

$\gamma_{Mcp} = 1{,}5$



¬ Steel resistance

$V_{Rd,s}$					Steel design shear resistance
Anchor size	M8	M10	M12	M16	M20
$V_{Rd,s}$	10,8	12,6	18,1	36,0	40,7

$\gamma_{Ms} = 1{,}27$ for M8 to M12, $\gamma_{Mc} = 1{,}25$ for M16 and $\gamma_{Mc} = 1{,}5$ for M20

$$N_{Rd} = \min(N_{Rd,p}\ ;\ N_{Rd,c}\ ;\ N_{Rd,s})$$
$$\beta_N = N_{Sd} / N_{Rd} \le 1$$

$$V_{Rd} = \min(V_{Rd,c}\ ;\ V_{Rd,cp}\ ;\ V_{Rd,s})$$
$$\beta_V = V_{Sd} / V_{Rd} \le 1$$

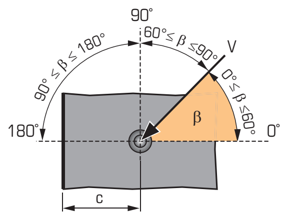
$$\beta_N + \beta_V \le 1{,}2$$

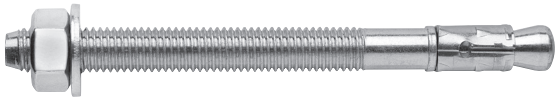
f_b INFLUENCE OF CONCRETE

Concrete class	f_b	Concrete class	f_b
C25/30	1,1	C40/50	1,41
C30/37	1,22	C45/55	1,48
C35/45	1,34	C50/60	1,55

$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

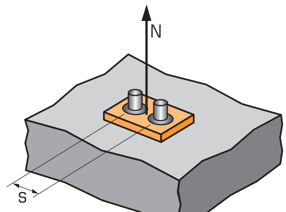
Angle β [°]	$f_{\beta,V}$
0 to 55	1
60	1,1
70	1,2
80	1,5
90 to 180	2





SPIT CC Method (values issued from ETA)

Ψ_s INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



$$\Psi_s = 0,5 + \frac{s}{6.h_{ef}}$$

$s_{min} < s < s_{cr,N}$

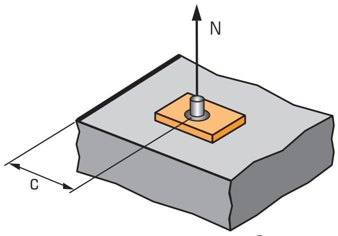
$s_{cr,N} = 3.h_{ef}$

Ψ_s must be used for each spacing influenced the anchors group

SPACING S — Reduction factor Ψ_s — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16	M20
50	0,68				
55	0,70	0,65			
75	0,77	0,71			
100	0,86	0,78			
120	0,93	0,83	0,79	0,74	0,70
140	1,00	0,89	0,83	0,77	0,73
180		1,00	0,93	0,85	0,80
210			1,00	0,91	0,85
255				1,00	0,93
280					0,97
300					1,00

$\Psi_{c,N}$ INFLUENCE OF EDGE FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



$$\Psi_{c,N} = 0,23 + 0,51 \; . \; \frac{c}{h_{ef}}$$

$c_{min} < c < c_{cr,N}$

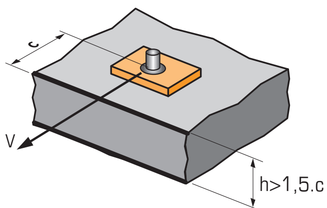
$c_{cr,N} = 1,5.h_{ef}$

$\Psi_{c,N}$ must be used for each distance influenced the anchors group.

EDGE C — Reduction factor $\Psi_{c,N}$ — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16	M20
50	1,00				
55		1,00			
60			1,00		
80				1,00	
100					1,00

$\Psi_{s-c,V}$ INFLUENCE OF SPACING AND EDGE DISTANCE FOR CONCRETE EDGE RESISTANCE IN SHEAR LOAD

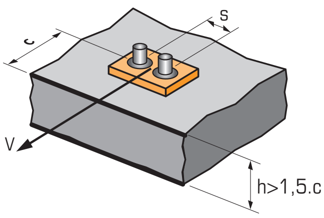


$$\Psi_{s-c,V} = \frac{c}{c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

For single anchor fastening

Reduction factor $\Psi_{s-c,V}$ — Cracked & non-cracked concrete

c/c_{min}	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2
$\Psi_{s-c,V}$	1,00	1,31	1,66	2,02	2,41	2,83	3,26	3,72	4,19	4,69	5,20	5,72

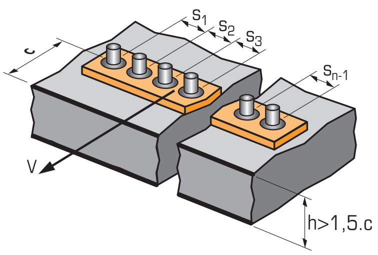


$$\Psi_{s-c,V} = \frac{3.c + s}{6.c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

For 2 anchors fastening

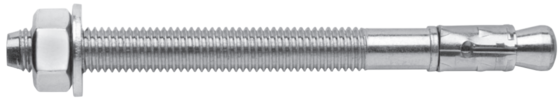
Reduction factor $\Psi_{s-c,V}$ — Cracked & non-cracked concrete

s/c_{min} \ c/c_{min}	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2
1,0	0,67	0,84	1,03	1,22	1,43	1,65	1,88	2,12	2,36	2,62	2,89	3,16
1,5	0,75	0,93	1,12	1,33	1,54	1,77	2,00	2,25	2,50	2,76	3,03	3,31
2,0	0,83	1,02	1,22	1,43	1,65	1,89	2,12	2,38	2,63	2,90	3,18	3,46
2,5	0,92	1,11	1,32	1,54	1,77	2,00	2,25	2,50	2,77	3,04	3,32	3,61
3,0	1,00	1,20	1,42	1,64	1,88	2,12	2,37	2,63	2,90	3,18	3,46	3,76
3,5		1,30	1,52	1,75	1,99	2,24	2,50	2,76	3,04	3,32	3,61	3,91
4,0			1,62	1,86	2,10	2,36	2,62	2,89	3,17	3,46	3,75	4,05
4,5				1,96	2,21	2,47	2,74	3,02	3,31	3,60	3,90	4,20
5,0					2,33	2,59	2,87	3,15	3,44	3,74	4,04	4,35
5,5						2,71	2,99	3,28	3,71	4,02	4,33	4,65
6,0						2,83	3,11	3,41	3,71	4,02	4,33	4,65



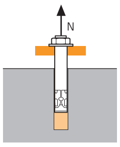
For 3 anchors fastening and more

$$\Psi_{s-c,V} = \frac{3.c + s_1 + s_2 + s_3 + ... + s_{n-1}}{3.n.c_{min}} . \sqrt{\frac{c}{c_{min}}}$$



SPIT CC Method (values issued from ETA - Seismic category C1)

TENSILE in kN

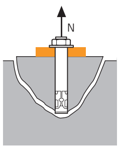


Pull-out resistance

$N_{Rd,p} = N^0_{Rd,p} \cdot f_b$

$N^0_{Rd,p,C1}$	Design pull-out resistance				
Anchor size	M8	M10	M12	M16	M20
Category C1 - Single anchor					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,p,C1}$ (C20/25)	3,1	4,9	10,7	13,3	-
Category C1 - Group of anchors [(1)]					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,p,C1}$ (C20/25)	2,7	4,2	9,1	11,3	17,0

(1) when more than one anchor of the group is submitted to tensile load
$\gamma_{Mc} = 1,5$

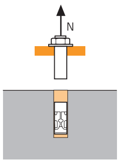


Concrete cone resistance

$N_{Rd,c} = N^0_{Rd,c} \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$

$N^0_{Rd,c,C1}$	Design cone resistance				
Anchor size	M8	M10	M12	M16	M20
Category C1 - Single anchor					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,c,C1}$ (C20/25)	6,2	9,5	11,9	16,0	20,4
Category C1 - Group of anchors [(1)]					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,c,C1}$ (C20/25)	5,4	8,4	10,5	14,1	18,0

(1) when more than one anchor of the group is submitted to tensile load
$\gamma_{Mc} = 1,5$

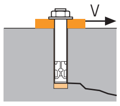


Steel resistance

$N_{Rd,s,C1}$	Steel design tensile resistance				
Anchor size	M8	M10	M12	M16	M20
$N_{Rd,s,C1}$	13,2	19,8	25,8	43,7	66,1

(1) when more than one anchor of the group is submitted to tensile load
$\gamma_{Ms} = 1,4$ for M8, $\gamma_{Mc} = 1,48$ for M10 to M16, and $\gamma_{Mc} = 1,5$ for M20

SHEAR in kN

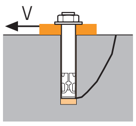


Concrete edge resistance

$V_{Rd,c} = V^0_{Rd,c} \cdot f_b \cdot f_{\beta,V} \cdot \Psi_{S-C,V}$

$V^0_{Rd,c,C1}$	Design concrete edge resistance at minimum edge distance (C_{min})				
Anchor size	M8	M10	M12	M16	M20
Category C1 - Single anchor					
h_{ef}	**46**	**60**	**70**	**85**	**100**
C_{min}	50	55	60	80	100
S_{min}	75	120	145	140	160
$V^0_{Rd,c,C1}$ (C20/25)	2,1	3,6	7,4	8,4	11,4
Category C1 - Group of anchors [(1)]					
h_{ef}	**46**	**60**	**70**	**85**	**100**
C_{min}	50	65	100	100	115
S_{min}	75	90	145	110	130
$V^0_{Rd,c,C1}$ (C20/25)	1,8	3,0	6,3	7,1	9,7

(1) when more than one anchor of the group is submitted to shear load
$\gamma_{Mc} = 1,5$

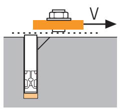


Pryout failure

$V_{Rd,cp} = V^0_{Rd,cp} \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$

$V^0_{Rd,cp,C1}$	Design pryout resistance				
Anchor size	M8	M10	M12	M16	M20
Category C1 - Single anchor					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$V^0_{Rd,cp,C1}$ (C20/25)	6,2	19,0	23,9	32,0	40,8
Category C1 - Group of anchors [(1)]					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$V^0_{Rd,cp,C1}$ (C20/25)	5,4	16,7	21,1	28,2	36,0

(1) when more than one anchor of the group is submitted to shear load
$\gamma_{Mc} = 1,5$



Steel resistance [(2)]

$V_{Rd,s,C1}$	Steel design shear resistance				
Anchor size	M8	M10	M12	M16	M20
Category C1 - Single anchor					
$V_{Rd,s,C1}$	4,8	12,6	18,1	36,0	40,7
Category C1 - Group of anchors [(1)]					
$V_{Rd,s,C1}$	4,1	10,7	15,4	30,6	34,6

(1) when more than one anchor of the group is submitted to shear load
(2) In case of no hole clearance between anchor and fixture
$\gamma_{Ms} = 1,25$ for M8 and M16, $\gamma_{Mc} = 1,27$ for M10 and M12, and $\gamma_{Mc} = 1,5$ for M20

$N_{Rd,C1} = \min(N_{Rd,p,C1} \; ; \; N_{Rd,c,C1} \; ; \; N_{Rd,s,C1})$
$\beta_N = N_{Sd} / N_{Rd,C1} \leq 1$

$V_{Rd,C1} = \min(V_{Rd,c,C1} \; ; \; V_{Rd,cp,C1} \; ; \; V_{Rd,s,C1})$
$\beta_V = V_{Sd} / V_{Rd,C1} \leq 1$

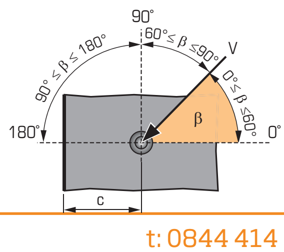
$$\beta_N + \beta_V \leq 1,2$$

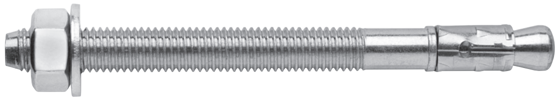
f_b INFLUENCE OF CONCRETE

Concrete class	f_b	Concrete class	f_b
C25/30	1,1	C40/50	1,41
C30/37	1,22	C45/55	1,48
C35/45	1,34	C50/60	1,55

$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

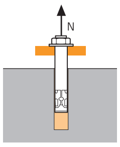
Angle β [°]	$f_{\beta,V}$
0 to 55	1
60	1,1
70	1,2
80	1,5
90 to 180	2





SPIT CC Method (values issued from ETA - Seismic category C2)

TENSILE in kN



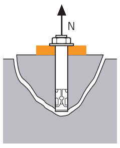
Pull-out resistance

$$N_{Rd,p,C2} = N^0_{Rd,p,C2} \cdot f_b$$

$N^0_{Rd,p,C2}$ — **Design pull-out resistance**

Anchor size	M8	M10	M12	M16	M20
Category C2 - Single anchor					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,p,C2}$ (C20/25)	NA	1,9	4,0	12,0	17,1
Category C2 - Group of anchors [(1)]					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,p,C2}$ (C20/25)	NA	1,6	3,4	10,2	14,5

(1) when more than one anchor of the group is submitted to tensile load
$\gamma_{Mc} = 1,5$



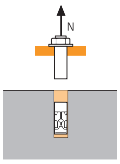
Concrete cone resistance

$$N_{Rd,c,C2} = N^0_{Rd,c,C2} \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$$

$N^0_{Rd,c,C2}$ — **Design cone resistance**

Anchor size	M8	M10	M12	M16	M20
Category C2 - Single anchor					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,c,C2}$ (C20/25)	NA	9,5	11,9	16,0	20,4
Category C2 - Group of anchors [(1)]					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$N^0_{Rd,c,C2}$ (C20/25)	NA	8,4	10,5	14,1	18,0

(1) when more than one anchor of the group is submitted to tensile load
$\gamma_{Mc} = 1,5$



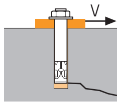
Steel resistance

$N_{Rd,s,C2}$ — **Steel design tensile resistance**

Anchor size	M8	M10	M12	M16	M20
$N_{Rd,s,C2}$	NA	19,5	25,5	43,1	66,1

(1) when more than one anchor of the group is submitted to tensile load
$\gamma_{Ms} = 1,5$ for M10, $\gamma_{Mc} = 1,48$ for M12 and M16, and $\gamma_{Mc} = 1,5$ for M20

SHEAR in kN



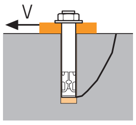
Concrete edge resistance

$$V_{Rd,c,C2} = V^0_{Rd,c,C2} \cdot f_b \cdot f_{\beta,V} \cdot \Psi_{S\text{-}C,V}$$

$V^0_{Rd,c,C2}$ — **Design concrete edge resistance at minimum edge distance (C_{min})**

Anchor size	M8	M10	M12	M16	M20
Category C2 - Single anchor					
h_{ef}	**46**	**60**	**70**	**85**	**100**
C_{min}	50	55	60	80	100
S_{min}	40	50	100	100	100
$V^0_{Rd,c,C2}$ (C20/25)	NA	3,6	7,4	8,4	11,4
Category C2 - Group of anchors [(1)]					
h_{ef}	**46**	**60**	**70**	**85**	**100**
C_{min}	50	65	100	100	115
S_{min}	40	50	100	100	100
$V^0_{Rd,c,C2}$ (C20/25)	NA	3,0	6,3	7,1	9,7

(1) when more than one anchor of the group is submitted to shear load
$\gamma_{Mc} = 1,5$



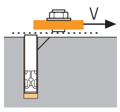
Pryout failure

$$V_{Rd,cp,C2} = V^0_{Rd,cp,C2} \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$$

$V^0_{Rd,cp,C2}$ — **Design pryout resistance**

Anchor size	M8	M10	M12	M16	M20
Category C2 - Single anchor					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$V^0_{Rd,cp,C2}$ (C20/25)	NA	19,0	23,9	32,0	40,8
Category C2 - Group of anchors [(1)]					
h_{ef}	**46**	**60**	**70**	**85**	**100**
$V^0_{Rd,cp,C2}$ (C20/25)	NA	16,7	21,1	28,2	36,0

(1) when more than one anchor of the group is submitted to shear load
$\gamma_{Mc} = 1,5$



Steel resistance [(2)]

$V_{Rd,s,C2}$ — **Steel design shear resistance**

Anchor size	M8	M10	M12	M16	M20
Category C2 - Single anchor					
$V_{Rd,s,C2}$	NA	7,6	11,0	27,1	29,8
Category C2 - Group of anchors [(1)]					
$V_{Rd,s,C2}$	NA	6,5	9,4	23,1	25,3

(1) when more than one anchor of the group is submitted to shear load
(2) In case of no hole clearance between anchor and fixture
$\gamma_{Ms} = 1,27$ for M10 and M12, $\gamma_{Mc} = 1,25$ for M16, and $\gamma_{Mc} = 1,5$ for M20

$$N_{Rd,C2} = \min(N_{Rd,p,C2}\ ;\ N_{Rd,c,C2}\ ;\ N_{Rd,s,C2})$$
$$\beta_N = N_{Sd} / N_{Rd,C2} \leq 1$$

$$V_{Rd,C2} = \min(V_{Rd,c,C2}\ ;\ V_{Rd,cp,C2}\ ;\ V_{Rd,s,C2})$$
$$\beta_V = V_{Sd} / V_{Rd,C2} \leq 1$$

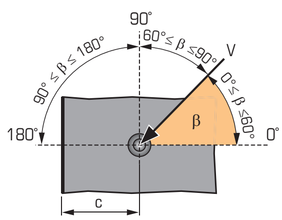
$$\beta_N + \beta_V \leq 1,2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b	Concrete class	f_b
C25/30	1,1	C40/50	1,41
C30/37	1,22	C45/55	1,48
C35/45	1,34	C50/60	1,55

$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

Angle β [°]	$f_{\beta,V}$
0 to 55	1
60	1,1
70	1,2
80	1,5
90 to 180	2



Mechanical anchors