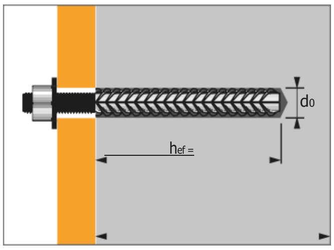
Vinylester resin for starter bar fastenings for use in cracked & non-cracked concrete and seismic performance C1 category

ETA Option 1-17/0514



Technical data

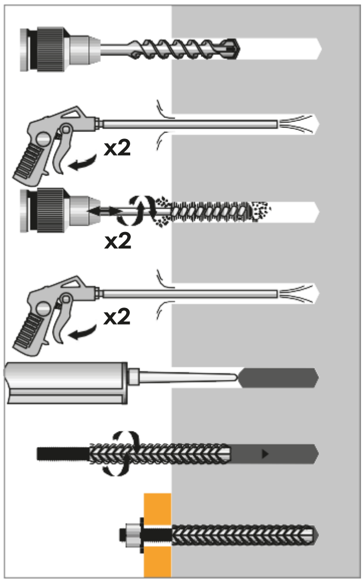
Anchor size	Min. anchor depth (mm) h_{ef}	Max. anchor depth (mm) h_{ef}	Min. thick. of base material (mm) h_{min}	Drilling diameter (mm) d_0
Ø8	56	160	h_{ef} + 30 mm	10
Ø10	70	200		12
Ø12	84	240		15
Ø16	112	320	h_{ef} + 2xd_0	18
Ø20	140	400		25

VIPER Vinylester resin, dual component cartridge 280 ml code: 060187
VIPER Vinylester resin, dual component cartridge 410 ml code: 060189/060188
VIPER Vinylester resin, dual component cartridge 825 ml code: 060190

APPLICATION

- Starter bar fastenings in non-reinforced concrete

INSTALLATION*



Mechanical characteristics

Nominal steel bar diameter		Ø8	Ø10	Ø12	Ø16	Ø20
Sections (cm^2)		0,503	0,785	1,13	2,01	3,14
Min. resistance to failure (kN)	Fe E400	21,13	32,97	47,46	84,42	131,88
	Fe E500	25,90	40,43	58,20	103,52	161,71
Ultimate limit load N_{Rd} (kN)	Fe E500	21,85	34,15	49,17	87,42	136,59

The mechanical characteristics of the high adhesion reabrs are defined in the –nfa 35-016 and NFA 35-017 standards.

***Premium cleaning :**
- 2 blowing with compressed air
- 2 brushing with brushed fitted on a drilling machine
- 2 blowing with compressed air

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 (3/5 and 5/5).

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	Ø8	Ø10	Ø12	Ø16	Ø20
Non-cracked concrete (C20/25)					
h_{ef}	**80**	**100**	**120**	**160**	**200**
$N_{Ru,m}$	30,7	47,9	68,9	122,4	191,2
N_{Rk}	27,7	43,2	62,2	110,4	172,5
Cracked concrete (C20/25)					
h_{ef}	**80**	**100**	**120**	**160**	**200**
$N_{Ru,m}$	20,3	32,7	48,4	89,6	144,5
N_{Rk}	15,8	25,5	37,7	69,8	112,6

SHEAR

Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Cracked & non-cracked concrete (C20/25)					
$V_{Ru,m}$	15,9	22,8	32,8	56,2	73,6
V_{Rk}	11,0	18,9	25,3	46,8	59,0

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	Ø8	Ø10	Ø12	Ø16	Ø20
Non-cracked concrete (C20/25)					
h_{ef}	**80**	**100**	**120**	**160**	**200**
N_{Rd}	18,4	28,8	41,4	73,6	115,0
Cracked concrete (C20/25)					
h_{ef}	**80**	**100**	**120**	**160**	**200**
N_{Rd}	10,5	17,0	25,1	46,5	75,1

$\gamma_{Mc} = 1,5$

SHEAR

Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Cracked & non-cracked concrete (C20/25)					
V_{Rd}	7,7	13,2	17,7	32,7	39,3

$\gamma_{Ms} = 1,43$

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	Ø8	Ø10	Ø12	Ø16	Ø20
Non-cracked concrete (C20/25)					
h_{ef}	**80**	**100**	**120**	**160**	**200**
N_{rec}	13,2	20,6	29,6	52,6	82,1
Cracked concrete (C20/25)					
h_{ef}	**80**	**100**	**120**	**160**	**200**
N_{rec}	7,5	12,1	18,0	33,2	53,6

$\gamma_F = 1,4$; $\gamma_{Mc} = 1,5$

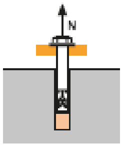
SHEAR

Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Cracked & non-cracked concrete (C20/25)					
V_{rec}	5,5	9,4	12,6	23,4	28,1

$\gamma_F = 1,4$; $\gamma_{Ms} = 1,43$

SPIT CC Method (values issued from ETA)

TENSILE in kN

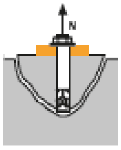


Pull-out resistance for dry and wet concrete (1)

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

$N^0_{Rd,p}$					Design pull-out resistance
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
h_{ef}	80	100	120	160	200
Non-cracked concrete (C20/25)	17,4	27,2	39,2	69,7	108,9
Cracked concrete (C20/25)	6,7	10,5	16,6	29,5	50,3

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

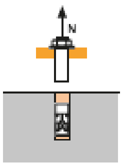


Concrete cone resistance for dry and wet concrete (1)

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

$N^0_{Rd,c}$					Design cone resistance
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
h_{ef}	80	100	120	160	200
Non-cracked concrete (C20/25)	24,0	33,6	44,2	68,0	95,0
Cracked concrete (C20/25)	17,2	24,0	31,5	48,6	67,9

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



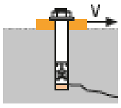
Steel resistance

$N_{Rd,s}$					Steel design tensile resistance
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Fe E500	20,0	30,7	44,3	79,3	123,6

γ_{Ms} Fe E500 = 1,4

(1) The concrete in the area of the anchorage is water statured. The anchor may be installed in flooded holes, but the figures above cannot be used, you must use the values given in the ETA for the category 2.

SHEAR in kN

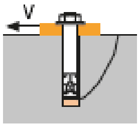


Concrete edge resistance

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

$V^0_{Rd,c}$					Design concrete edge resistance at minimum edge distance (C_{min})
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Cracked & non-cracked concrete (C20/25)					
h_{ef}	80	100	120	160	200
C_{min}	40	45	45	50	65
S_{min}	40	50	60	80	100
$V^0_{Rd,c}$	2,4	3,2	3,5	4,7	7,8

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

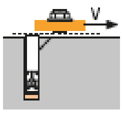


Pryout failure

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

$V^0_{Rd,cp}$					Design pryout resistance
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
h_{ef}	80	100	120	160	200
Non-cracked concrete (C20/25)	34,9	54,5	78,4	136,0	190,1
Cracked concrete (C20/25)	13,4	20,9	33,2	59,0	100,5

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



Steel resistance

$V_{Rd,s}$					Steel design shear resistance
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Fe E500	11,2	17,6	24,8	44,0	68,8

γ_{Ms} Fe E500 = 1,4

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

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

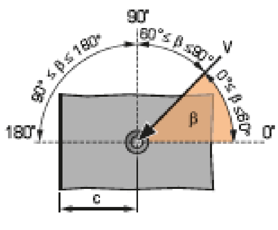
$$\beta_N + \beta_V \leq 1{,}2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b Non-cracked concrete	f_b Cracked concrete
C25/30	1,02	1,00
C30/37	1,05	1,00
C40/50	1,07	1,00
C50/60	1,09	1,00

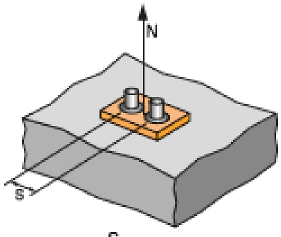
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

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



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

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

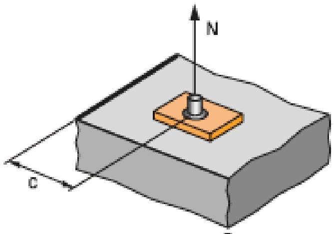
$s_{cr,N} = 3.h_{ef}$

Ψ_s must be used for each spacing influenced the anchors group.

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

Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
40	0,58				
50	0,60	0,58			
60	0,63	0,60	0,58		
80	0,67	0,63	0,61	0,58	
100	0,71	0,67	0,64	0,60	0,58
150	0,81	0,75	0,71	0,66	0,63
200	0,92	0,83	0,78	0,71	0,67
240	1,00	0,90	0,83	0,75	0,70
300		1,00	0,92	0,81	0,75
360			1,00	0,88	0,80
480				1,00	0,90
600					1,00

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



$$\Psi_{c,N} = 0,25 + 0,5\frac{c}{h_{ef}}$$

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

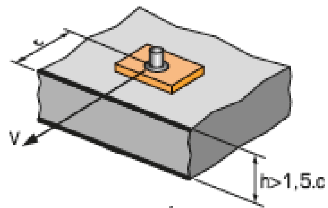
$c_{cr,N} = 1.5h_{ef}$

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

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

Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
40	0,50				
45	0,53	0,48	0,44		
50	0,56	0,50	0,46	0,41	
65	0,66	0,58	0,52	0,45	0,41
80	0,75	0,65	0,58	0,50	0,45
120	1,00	0,85	0,75	0,63	0,55
150		1,00	0,88	0,72	0,63
180			1,00	0,81	0,70
240				1,00	0,85
300					1,00

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

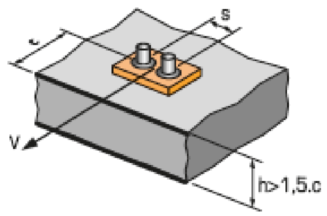


$$\Psi_{s\text{-}c,V} = \frac{c}{c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$

For single anchor fastening

Reduction factor $\Psi_{s\text{-}c,V}$ — 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
$\Psi_{s\text{-}c,V}$	1,00	1,31	1,66	2,02	2,41	2,83	3,26	3,72	4,19	4,69	5,20	5,72

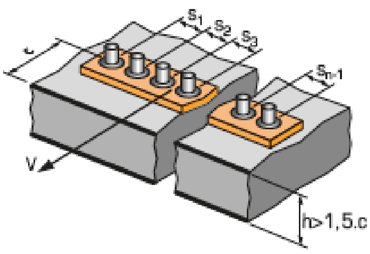


$$\Psi_{s\text{-}c,V} = \frac{3.c + s}{6.c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$

For 2 anchors fastening

Reduction factor $\Psi_{s\text{-}c,V}$ — 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

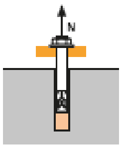


For 3 anchors fastening and more

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

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

TENSILE in kN

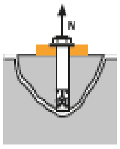


Pull-out resistance for dry and wet concrete (1)

$N_{Rd,p,C1} = N^0_{Rd,p,C1} \cdot f_b$

$N^0_{Rd,p,C1}$				Design pull-out resistance	
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Category C1 - Single anchor					
h_{ef}	80	100	120	160	200
$N^0_{Rd,p,C1}$ (C20/25)	4,8	8,0	16,4	28,9	49,8
Category C1 - Group of anchors (1)					
h_{ef}	80	100	120	160	200
$N^0_{Rd,p,C1}$ (C20/25)	4,0	6,8	14,0	24,6	42,3

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

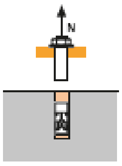


Concrete cone resistance for dry and wet concrete (1)

$N_{Rd,c,C1} = N^0_{Rd,c,C1} \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$

$N^0_{Rd,c,C1}$				Design cone resistance	
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Category C1 - Single anchor					
h_{ef}	80	100	120	160	200
$N^0_{Rd,c,C1}$ (C20/25)	14,6	20,4	26,8	41,3	57,7
Category C1 - Group of anchors (1)					
h_{ef}	80	100	120	160	200
$N^0_{Rd,c,C1}$ (C20/25)	12,9	18,0	23,7	36,4	50,9

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



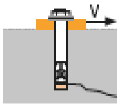
Steel resistance

$N_{Rd,s,C1}$				Steel design tensile resistance	
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
$N_{Rd,s,C1}$	20,0	30,7	44,3	79,3	123,6

γ_{Ms} Fe E500 = 1,4

(1) The concrete in the area of the anchorage is water statured. The anchor may be installed in flooded holes, but the figures above cannot be used, you must use the values given in the ETA for the category 2.

SHEAR in kN

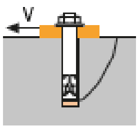


Concrete edge resistance

$V_{Rd,c,C1} = V^0_{Rd,c,C1} \cdot f_b \cdot f_{\beta,V} \cdot \Psi_{S\text{-}C,V}$

$V^0_{Rd,c,C1}$				Design pull-out resistance	
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Category C1 - Single anchor					
h_{ef}	80	100	120	160	200
C_{min}	40	45	45	50	65
S_{min}	40	50	60	80	100
$V^0_{Rd,c,C1}$ (C20/25)	2,5	3,8	5,5	9,4	15,4
Category C1 - Group of anchors (1)					
h_{ef}	80	100	120	160	200
C_{min}	40	45	45	50	65
S_{min}	40	50	60	80	100
$V^0_{Rd,c,C1}$ (C20/25)	2,2	3,3	4,7	8,0	13,1

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

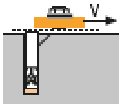


Pryout failure

$V_{Rd,cp,C1} = V^0_{Rd,cp,C1} \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$

$V^0_{Rd,cp,C1}$				Design cone resistance	
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Category C1 - Single anchor					
h_{ef}	80	100	120	160	200
$V^0_{Rd,cp,C1}$ (C20/25)	29,2	40,8	53,6	82,6	115,4
Category C1 - Group of anchors (1)					
h_{ef}	80	100	120	160	200
$V^0_{Rd,cp,C1}$ (C20/25)	25,8	36,0	47,3	72,9	101,8

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



Steel resistance

$V_{Rd,s,C1}$				Steel design shear resistance	
Anchor size	Ø8	Ø10	Ø12	Ø16	Ø20
Category C1 - Single anchor					
$V_{Rd,s,C1}$	7,8	12,3	17,4	30,8	48,2
Category C1 - Group of anchors (1)					
$V_{Rd,s,C1}$	6,7	10,5	14,8	26,2	40,9

(1) when more than one anchor of the group is submitted to tensile load
γ_{Ms} Fe E500 = 1,4

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

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

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

f_b INFLUENCE OF CONCRETE

Concrete class	f_b Non-cracked concrete	f_b Cracked concrete
C25/30	1,02	1,00
C30/37	1,05	1,00
C40/50	1,07	1,00
C50/60	1,09	1,00

$f_{\beta,V}$ 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