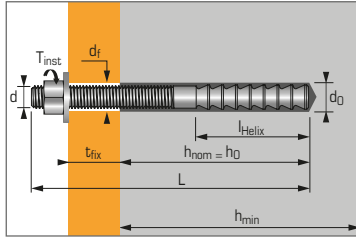


Vinylester resin - For use in cracked & non-cracked concrete and seismic performance C1&C2 categories



ETA Option 1- 17/0514



APPLICATION

- Steel profiles
- Fixing machinery (resistant to vibration)
- Storage tanks, pipes
- Signs
- Guard rails
- Electrical insulated fixings

MATERIAL

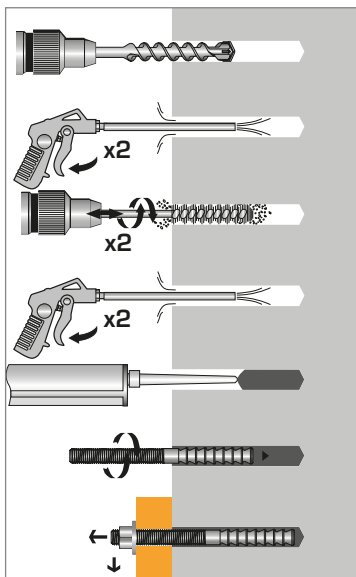
XTREM anchor rod zinc coated steel version:

Anchor rod :

Steel grade 8.8 cold form steel
NF A35-053

- Nut :** Steel grade 6 or 8
NF EN 20898-2
- Washer :** Steel DIN 513
- Protection :** zinc coated 5 µm min.
NF E25-009

INSTALLATION*



*Premium cleaning :

- 2 blowing with compressed air
- 2 brushing with brushed fitted on a drilling machine
- 2 blowing with compressed air

Technical data

Anchor size	Anchor depth		Thickness of part to be fixed		Min. thick. of base material (mm) h_{min}	Thread \emptyset (mm) d	Drilling \emptyset (mm) d_0	Clearance \emptyset (mm) d_f	Total anchor length (mm) L	Tighten torque (Nm) T_{inst}	Code* XTREM anchor rod Zinc coated steel version
	$h_{ef} min.$	$h_{ef} max.$	$t_{fix} max.$	$t_{fix} min.$							
M12X150	60	108	77	29	$h_{ef} + 30$ mm	12	14	14	150	30	060191
M12X205	60	144	132	48		12	14	14	205	30	060192
M16X200	95	144	89	40	$h_{ef} + 2d_0$	16	18	18	200	50	060193
M16X250	95	192	139	42		16	18	18	248	50	060194
M20X270	100	180	151	71		20	22	22	270	150	060195
M20X330	100	240	211	71		20	22	22	330	150	060196
VIPER Vinylester resin, dual component cartridge 280 ml											060187
VIPER Vinylester resin, dual component cartridge 410 ml											060189 / 060188
VIPER Vinylester resin, dual component cartridge 825 ml											060190

Anchor mechanical properties

Anchor size		M12	M16	M20
XTREM anchor rod				
f_{uk} (N/mm ²)	Min. tensile strength	800	800	800
f_{yk} (N/mm ²)	Yield strength	640	640	640
$M^{0}_{rk,s}$ (Nm)	Characteristic bending moment	105	266	519
M (Nm)	Recommended bending moment	42	106	207

Setting time

Temperature	Max. time for installation	Curing time
-10°C ▶ -5°C	90 min.	24 h
-4°C ▶ 0°C	50 min.	240 min.
1°C ▶ 5°C	25 min.	120 min.
6°C ▶ 10°C	15 min.	90 min.
11°C ▶ 20°C	7 min.	60 min.
21°C ▶ 30°C	4 min.	45 min.
31°C ▶ 40°C	2 min.	30 min.

Chemical resistance of the SPIT VIPER resin

Chemical substances	Concentration (%)	Resistance	Chemical substances	Concentration (%)	Resistance
Acetic acid	50-75	(o)	Heptane	100	(+)
Acetic acid	0-50	(+)	Hexane	100	(o)
Acetone	10	(+)	Hydrochloric acid	25	(o)
Ammonium hydroxide or Ammoniac	20	(o)	Hydrochloric acid	15	(+)
Ammonium hydroxide or Ammoniac	5	(+)	Lactic acid	0-100	(+)
Bromine water	5	(+)	Nitric acid	feb-15	(o)
Chlorine water	0-100	(+)	Phosphoric acid	80	(+)
Citric acid	0-100	(+)	Phosphoric acid, vapor and condensed		(+)
Concentrated phosphoric acid	100	(+)	Sea water	0-100	(+)
Deionized water	0-100	(+)	Sodium carbonate	10	(+)
DeminerIALIZED water		(+)	Sodium chloride	0-100	(+)
Diesel fuel	0-100	(+)	Sodium hydroxide (or Caustic soda)	25	(o)
Ethyl alcohol (Ethanol)	10	(o)	Sulfuric acid	71-75	(o)
Ethylene glycol	0-100	(+)	Sulfuric acid	0-70	(+)
Formic acid	10	(+)	Sulfuric acid	Fumes	(+)
Fuel	100	(+)	Sulfuric acid / Phosphoric acid	10:20	(+)
Heavy motor oil	100	(+)	Turpentine (oil)		(o)

Resistant (+): the samples in contact with the substances did not show any Screwable damage such as cracks, attacked surfaces, burst corners nor large swelling. **Sensitive (o):** use with care regarding exposure of the field of usage, precautions to be taken. The samples in contact with the substance slightly attacked the material.



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).

Number of sealings per cartridge

Anchor size	M12	M16	M20
Drilling diameter (mm)	14	18	22
Drilling depth (mm)	80	90	110
Number of sealings per cartridge			
VIPER 825 ml	77	48	26
VIPER 410 ml	38	24	13
VIPER 280 ml	26	16	9

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	M12	M16	M20
Non-cracked concrete (C20/25)			
h_{ef}	60	96	100
$N_{Ru,m}$	33,5	66,5	82,6
N_{Rk}	28,3	56,1	69,6
Cracked concrete (C20/25)			
h_{ef}	60	96	100
$N_{Ru,m}$	31,2	56,4	63,6
N_{Rk}	26,4	51,3	58,1

SHEAR

Anchor size	M12	M16	M20
Cracked & non-cracked concrete (C20/25)			
$V_{Ru,m}$	37	70	108
V_{Rk}	34	63	98

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

$$N_{Rd} = \frac{N_{Rk}^*}{\gamma_{Mc}} \quad \text{*Derived from test results (stud grade 10.9)}$$

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

TENSILE

Anchor size	M12	M16	M20
Non-cracked concrete (C20/25)			
h_{ef}	60	96	100
N_{Rd}	18,8	37,4	46,4
Cracked concrete (C20/25)			
h_{ef}	60	96	100
N_{Rd}	17,6	34,2	38,7

SHEAR

Anchor size	M12	M16	M20
Cracked & non-cracked concrete (C20/25)			
V_{Rd}	27	50,4	78,4
$\gamma_{Ms} = 1,25$			

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

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

$$N_{rec} = \frac{N_{Rk}^*}{\gamma_M \cdot \gamma_F} \quad \text{*Derived from test results (stud grade 10.9)}$$

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

TENSILE

Anchor size	M12	M16	M20
Non-cracked concrete (C20/25)			
h_{ef}	60	96	100
N_{rec}	13,5	26,7	33,1
Cracked concrete (C20/25)			
h_{ef}	60	96	100
N_{rec}	12,6	24,4	27,6

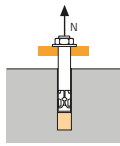
SHEAR

Anchor size	M12	M16	M20
Cracked & non-cracked concrete (C20/25)			
V_{rec}	19,3	36	56
$\gamma_F = 1,4 ; \gamma_{Ms} = 1,25$			

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

SPIT CC Method (values issued from ETA)

TENSILE in kN

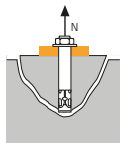


→ Pull-out resistance for dry and wet concrete ⁽¹⁾

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

$N^0_{Rd,p}$	Design pull-out resistance		
Anchor size	M12	M16	M20
$h_{ef, min}$	60	96	100
$h_{ef, max}$	144	192	240
Non-cracked concrete (C20/25)			
$N^0_{Rd,p} (h_{ef, min})$	25,6	54,7	71,2
Cracked concrete (C20/25)			
$N^0_{Rd,p} (h_{ef, min})$	25,6	51,5	58,6

$\gamma_{Mc} = 1,5$

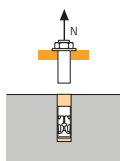


→ Concrete cone resistance for dry and wet concrete ⁽¹⁾

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

$N^0_{Rd,c}$	Design cone resistance		
Anchor size	M12	M16	M20
$h_{ef, min}$	60	96	100
$h_{ef, max}$	144	192	240
Non-cracked concrete (C20/25)			
$N^0_{Rd,c} (h_{ef, min})$	15,6	31,6	33,6
$N^0_{Rd,c} (h_{ef, max})$	58,1	89,4	124,9
Cracked concrete (C20/25)			
$N^0_{Rd,c} (h_{ef, min})$	11,2	22,6	24,0
$N^0_{Rd,c} (h_{ef, max})$	41,5	63,9	89,2

$\gamma_{Mc} = 1,5$



→ Steel resistance

$N_{Rd,s}$	Steel design tensile resistance		
Anchor size	M12	M16	M20
Xtrem anchor rod Zn.	33,3	59,3	93,3

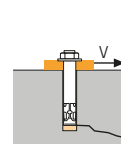
$\gamma_{Ms} = 1,5$

⁽¹⁾ The concrete in the area of the anchorage is water saturated. 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.

$$N_{Rd} = \min(N_{Rd,p} ; N_{Rd,c} ; N_{Rd,s})$$

$$\beta_N = N_{Sd} / N_{Rd} \leq 1$$

SHEAR in kN

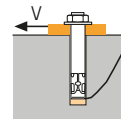


→ Concrete edge resistance

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

$V^0_{Rd,c}$	Design concrete edge resistance at minimum edge distance (C_{min})		
Anchor size	M12	M16	M20
$h_{ef, min}$	60	96	100
$h_{ef, max}$	144	192	240
C_{min}	50	60	120
S_{min}	50	60	120
Non-cracked concrete (C20/25)			
$V^0_{Rd,c} (h_{ef, min})$	3,5	5,6	17,0
$V^0_{Rd,c} (h_{ef, max})$	4,5	6,9	21,7
Cracked concrete (C20/25)			
$V^0_{Rd,c} (h_{ef, min})$	2,5	4,0	12,2
$V^0_{Rd,c} (h_{ef, max})$	3,2	4,9	15,5

$\gamma_{Mc} = 1,5$

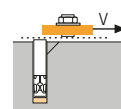


→ Pryout failure

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

$V^0_{Rd,cp}$	Design pryout resistance		
Anchor size	M12	M16	M20
$h_{ef, min}$	60	96	100
$h_{ef, max}$	144	192	240
Non-cracked concrete (C20/25)			
$V^0_{Rd,cp} (h_{ef, min})$	31,2	63,2	67,2
$V^0_{Rd,cp} (h_{ef, max})$	51,3	109,4	142,4
Cracked concrete (C20/25)			
$V^0_{Rd,cp} (h_{ef, min})$	15,1	35,4	48,0
$V^0_{Rd,cp} (h_{ef, max})$	51,3	102,9	117,3

$\gamma_{Mcp} = 1,5$



→ Steel resistance

$V_{Rd,s}$	Steel design shear resistance		
Anchor size	M12	M16	M20
Xtrem anchor rod Zn.	27,2	50,4	78,4

$\gamma_{Ms} = 1,25$

$$V_{Rd} = \min(V_{Rd,c} ; V_{Rd,cp} ; V_{Rd,s})$$

$$\beta_V = V_{Sd} / V_{Rd} \leq 1$$

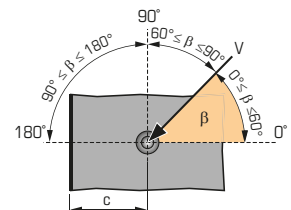
$$\beta_N + \beta_V \leq 1,2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b Cracked & non-cracked concrete		
	M12	M16	M20
C25/30	1,02	1,02	1,07
C30/37	1,08	1,08	1,17
C40/50	1,15	1,15	1,32
C50/60	1,19	1,19	1,42

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

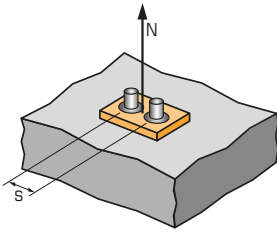
Angle β [°]	$f_{\beta,V}$
0 to 55	1
60	1,1
70	1,2
80	1,5
90 to 180	2





SPIT CC Method (values issued from ETA)

Ψ_s INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



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

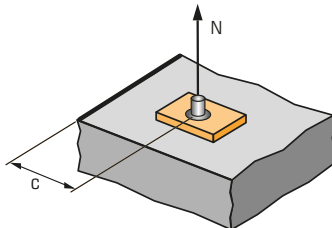
$$s_{min} < S < s_{cr,N}$$

$$s_{cr,N} = 3 \cdot h_{ef}$$

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

SPACING S	Reduction factor Ψ_s Cracked & non-cracked concrete			
	Anchor size	M12	M16	M20
40		0,61		
50		0,64		
60		0,67	0,60	
80		0,72	0,64	
100		0,78	0,67	0,67
150		0,92	0,76	0,75
200		1,00	0,85	0,83
240		1,00	0,92	0,90
300		1,00	1,00	1,00
360			1,00	1,00
480				1,00
600				1,00

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



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

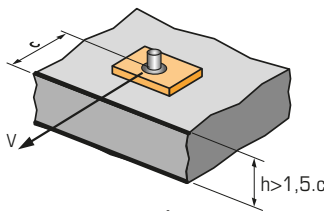
$$c_{min} < C < c_{cr,N}$$

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

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

EDGE C	Reduction factor $\Psi_{c,N}$ Cracked & non-cracked concrete			
	Anchor size	M12	M16	M20
40		0,58		
45		0,63	0,48	
50		0,67	0,51	0,50
65		0,79	0,59	0,58
80		0,92	0,67	0,65
120		1,00	0,88	0,85
150			1,00	1,00
180			1,00	1,00
240				1,00
300				1,00

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



$$\Psi_{s-c,V} = \frac{C}{C_{min}} \cdot \sqrt{\frac{C}{C_{min}}}$$

For single anchor fastening

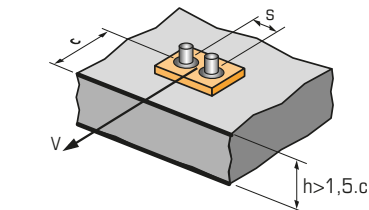
$\frac{C}{C_{min}}$	Reduction factor $\Psi_{s-c,V}$ Cracked & non-cracked concrete											
	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2
$\Psi_{s-c,V}$	1,00	1,31	1,66	2,02	2,41	2,83	3,26	3,72	4,19	4,69	5,20	5,72

For 2 anchors fastening

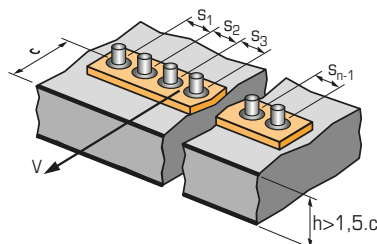
$\frac{S}{C_{min}}$	$\frac{C}{C_{min}}$	Reduction factor $\Psi_{s-c,V}$ Cracked & non-cracked concrete											
		1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2
1,0	0,67	0,84	1,03	1,22	1,43	1,65	1,88	2,12	2,36	2,62	2,89	3,16	
1,5	0,75	0,93	1,12	1,33	1,54	1,77	2,00	2,25	2,50	2,76	3,03	3,31	
2,0	0,83	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

$$\Psi_{s-c,V} = \frac{3 \cdot C + S_1 + S_2 + S_3 + \dots + S_{n-1}}{3 \cdot n \cdot C_{min}} \cdot \sqrt{\frac{C}{C_{min}}}$$



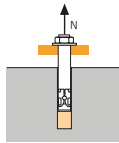
$$\Psi_{s-c,V} = \frac{3 \cdot C + S}{6 \cdot C_{min}} \cdot \sqrt{\frac{C}{C_{min}}}$$



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

TENSILE in kN

→ Pull-out resistance

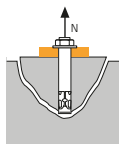


$$N_{Rd,p,C1} = N_{Rd,p,C1}^0 \cdot f_b$$

$N_{Rd,p,C1}^0$	Design pull-out resistance		
Anchor size	M12	M16	M20
Category C1 - Single anchor			
h_{ef}	60	96	120
$N_{Rd,p,C1}^0$ (C20/25)	25,6	43,8	49,8
Category C1 - Group of anchors ⁽¹⁾			
h_{ef}	60	96	120
$N_{Rd,p,C1}^0$ (C20/25)	21,8	37,2	42,4

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

→ Concrete cone resistance

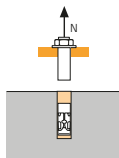


$$N_{Rd,c,C1} = N_{Rd,c,C1}^0 \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$$

$N_{Rd,c,C1}^0$	Design cone resistance		
Anchor size	M12	M16	M20
$h_{ef, min}$	60	96	100
$h_{ef, max}$	144	192	240
Category C1 - Single anchor			
$N_{Rd,c,C1}^0$ ($h_{ef, min}$)	9,5	19,2	20,4
$N_{Rd,c,C1}^0$ ($h_{ef, max}$)	35,3	54,3	75,8
Category C1 - Group of anchors ⁽¹⁾			
$N_{Rd,c,C1}^0$ ($h_{ef, min}$)	8,4	16,9	18,0
$N_{Rd,c,C1}^0$ ($h_{ef, max}$)	31,1	47,9	66,9

⁽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	M12	M16	M20
Xtrem anchor rod Zn.	33,3	59,3	93,3

$\gamma_{Ms} = 1,5$

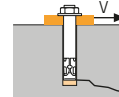
⁽¹⁾ The concrete in the area of the anchorage is water saturated. The anchor may be installed in flooded holes, but the figures above cannot be used, you must use the values given in the ETA for the category 2.

$$N_{Rd,C1} = \min(N_{Rd,p,C1} ; N_{Rd,c,C1} ; N_{Rd,s,C1})$$

$$\beta_N = N_{Sd} / N_{Rd,C1} \leq 1$$

SHEAR in kN

→ Concrete edge resistance



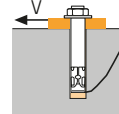
$$V_{Rd,c,C1} = V_{Rd,c,C1}^0 \cdot f_b \cdot f_{\beta,V} \cdot \Psi_{S,C,V}$$

$V_{Rd,c,C1}^0$	Design concrete edge resistance at minimum edge distance (C_{min})		
Anchor size	M12	M16	M20
$h_{ef, min}$	60	96	100
$h_{ef, max}$	144	192	240
C_{min}	50	60	120
S_{min}	50	60	120

Category C1 - Single anchor			
$V_{Rd,c,C1}^0$ ($h_{ef, min}$)	2,5	4,0	12,2
$V_{Rd,c,C1}^0$ ($h_{ef, max}$)	3,0	4,6	14,5
Category C1 - Group of anchors ⁽¹⁾			
$V_{Rd,c,C1}^0$ ($h_{ef, min}$)	2,2	3,4	10,3
$V_{Rd,c,C1}^0$ ($h_{ef, max}$)	2,6	3,9	12,3

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

→ Pryout failure



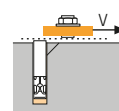
$$V_{Rd,cp,C1} = V_{Rd,cp,C1}^0 \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$$

$V_{Rd,cp,C1}^0$	Design pryout resistance		
Anchor size	M12	M16	M20
Category C1 - Single anchor			
h_{ef}	60	96	100
$V_{Rd,cp,C1}^0$ ($h_{ef, min}$)	19,0	38,4	40,8
$V_{Rd,cp,C1}^0$ ($h_{ef, max}$)	51,3	86,9	100,5

Category C1 - Group of anchors ⁽¹⁾			
h_{ef}	60	96	100
$V_{Rd,cp,C1}^0$ ($h_{ef, min}$)	16,7	33,9	36,0
$V_{Rd,cp,C1}^0$ ($h_{ef, max}$)	43,6	73,8	85,5

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

→ Steel resistance



$V_{Rd,s,C1}$	Steel design tensile resistance		
Anchor size	M12	M16	M20
Category C1 - Single anchor			
Xtrem anchor rod Zn.	18,9	35,2	54,9
Category C1 - Group of anchors ⁽¹⁾			
Xtrem anchor rod Zn.	16,0	29,9	46,6

⁽¹⁾ when more than one anchor of the group is submitted to shear load
 $\gamma_{Ms} = 1,25$

$$V_{Rd,C1} = \min(V_{Rd,c,C1} ; V_{Rd,cp,C1} ; V_{Rd,s,C1})$$

$$\beta_V = V_{Sd} / V_{Rd,C1} \leq 1$$

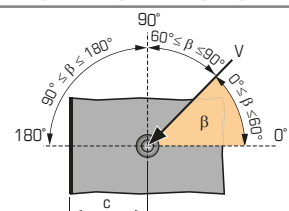
$$\beta_N + \beta_V \leq 1,2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b Cracked & non-cracked concrete		
	M12	M16	M20
C25/30	1,02	1,02	1,07
C30/37	1,08	1,08	1,17
C40/50	1,15	1,15	1,32
C50/60	1,19	1,19	1,42

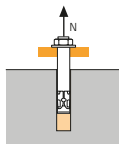
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

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

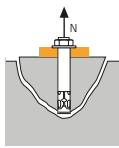


→ Résistance à la rupture extraction-glissement

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

$N_{Rd,p,C2}^0$	Design pull-out resistance		
Anchor size	M12	M16	M20
Category C2 - Single anchor			
h_{ef}	60	96	120
$N_{Rd,p,C2}^0$ (C20/25)	10,6	30,6	29,3
Category C2 - Group of anchors ⁽¹⁾			
h_{ef}	60	96	120
$N_{Rd,p,C2}^0$ (C20/25)	9,0	26,0	24,9

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

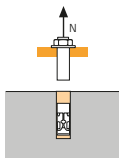


→ Concrete cone resistance

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

$N_{Rd,c,C2}^0$	Design cone resistance		
Anchor size	M12	M16	M20
$h_{ef, min}$	60	96	100
$h_{ef, max}$	144	192	240
Category C2 - Single anchor			
$N_{Rd,c,C2}^0$ ($h_{ef, min}$)	9,5	19,2	20,4
$N_{Rd,c,C2}^0$ ($h_{ef, max}$)	35,3	54,3	75,8
Category C2 - Group of anchors ⁽¹⁾			
$N_{Rd,c,C2}^0$ ($h_{ef, min}$)	8,4	16,9	18,0
$N_{Rd,c,C2}^0$ ($h_{ef, max}$)	31,1	47,9	66,9

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



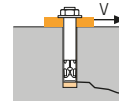
→ Steel resistance

$N_{Rd,s,C2}$	Steel design tensile resistance		
Anchor size	M12	M16	M20
Xtrem anchor rod Zn.	33,3	59,3	93,3

$\gamma_{Ms} = 1,5$

⁽¹⁾ The concrete in the area of the anchorage is water saturated. 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



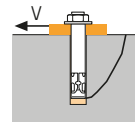
→ Concrete edge resistance

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

$V_{Rd,c,C2}^0$	Design concrete edge resistance at minimum edge distance (C_{min})		
Anchor size	M12	M16	M20
$h_{ef, min}$	60	96	100
$h_{ef, max}$	144	192	240
C_{min}	50	60	120
S_{min}	50	60	120

Category C2 - Single anchor			
$V_{Rd,c,C2}^0$ ($h_{ef, min}$)	2,5	4,0	12,2
$V_{Rd,c,C2}^0$ ($h_{ef, max}$)	3,0	4,6	14,5
Category C2 - Group of anchors ⁽¹⁾			
$V_{Rd,c,C2}^0$ ($h_{ef, min}$)	2,2	3,4	10,3
$V_{Rd,c,C2}^0$ ($h_{ef, max}$)	2,6	3,9	12,3

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

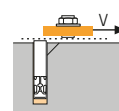


→ Pryout failure

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

$V_{Rd,cp,C2}^0$	Design pryout resistance		
Anchor size	M12	M16	M20
Category C2 - Single anchor			
h_{ef}	60	96	100
$V_{Rd,cp,C2}^0$ ($h_{ef, min}$)	19,0	38,4	40,8
$V_{Rd,cp,C2}^0$ ($h_{ef, max}$)	21,4	61,8	57,0
Category C2 - Group of anchors ⁽¹⁾			
h_{ef}	60	96	100
$V_{Rd,cp,C2}^0$ ($h_{ef, min}$)	16,7	33,9	36,0
$V_{Rd,cp,C2}^0$ ($h_{ef, max}$)	18,2	52,5	48,4

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



→ Steel resistance

$V_{Rd,s,C2}$	Steel design shear resistance		
Anchor size	M12	M16	M20
Category C2 - Single anchor			
Xtrem anchor rod Zn.	18,9	35,2	54,9
Category C2 - Group of anchors ⁽¹⁾			
Xtrem anchor rod Zn.	16,0	29,9	46,6

⁽¹⁾ when more than one anchor of the group is submitted to shear load
 $\gamma_{Ms} = 1,25$

$$N_{Rd,C2} = \min(N_{Rd,p,C2} ; N_{Rd,c,C2} ; N_{Rd,s,C2})$$

$$\beta_N = N_{Sd} / N_{Rd,C2} \leq 1$$

$$V_{Rd,C2} = \min(V_{Rd,c,C2} ; V_{Rd,cp,C2} ; V_{Rd,s,C2})$$

$$\beta_V = V_{Sd} / V_{Rd,C2} \leq 1$$

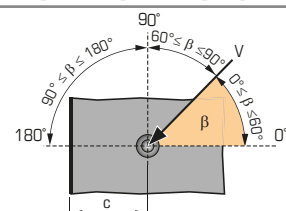
$$\beta_N + \beta_V \leq 1,2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b Cracked & non-cracked concrete		
	M12	M16	M20
C25/30	1,02	1,02	1,07
C30/37	1,08	1,08	1,17
C40/50	1,15	1,15	1,32
C50/60	1,19	1,19	1,42

$f_{\beta,V}$ 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



Chemical anchors