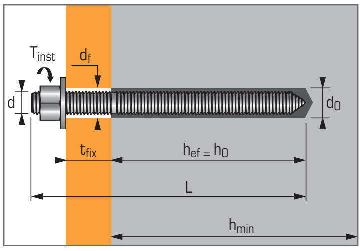
Vinylester resin - For use in cracked & non-cracked concrete and seismic performance C1 category

European Technical Assessment
ETA Option 1- 17/0514

XTREM
INOX STAINLESS STEEL
TR TROPICAL VERSION



APPLICATION

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

WRAS APPROVED PRODUCT

MATERIAL

Resin :
Vinylester resin, dual component cartridge

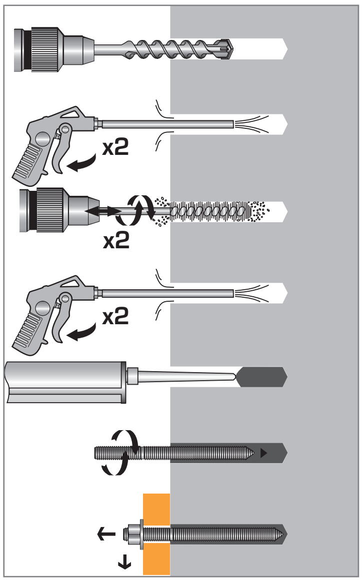
Zinc coated steel version :

- **Stud M8-M30 :** Steel grade 5.8 as per ISO 898-1
- **Nut :** Steel grade 6 or 8 NF EN 20898-2
- **Washer :** Steel DIN 513
- **Protection :** zinc coated 5 µm min. NF E25-009

Stainless steel version :

- **Stud M8-M24:** A4-70 as per ISO 3506-1
- **Nut :** Stainless steel A4-80, NF EN 10088-3
- **Washer :** Stainless steel A4, NF EN 20898-2

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	Min. anchor depth (mm) h_{ef}	Max. thick. of part to be fixed (mm) t_{fix}	Min. thick. of base material (mm) h_{min}	Thread diameter (mm) d	Drilling depth (mm) h_0	Drilling diameter (mm) d_0	Clearance diameter (mm) d_f	Total anchor length (mm) L	Tighten torque (Nm) T_{inst}	Code* SPIT stud zinc coated st.	Code* SPIT stud stainless steel A4
M8X110	80	15	110	8	80	10	9	110	10	060215	060222
M10X130	90	20	120	10	90	12	12	130	20	060216	060223
M12X160	110	25	140	12	110	14	14	160	30	060217	060224
M16X190	125	35	160	16	125	18	18	190	60	060218	060225
M20X260	170	65	220	20	170	25	22	260	120	060219	060226
M24X300	210	63	265	24	210	28	26	300	200	060220	060227
M30X380	280	70	350	30	280	35	33	380	400	060221	-
VIPER XTREM cartridge 280 ml										060187	
VIPER XTREM cartridge 410 ml										060189/060188	
VIPER XTREM TR cartridge (Tropical version) 410 ml										060201	
VIPER XTREM cartridge 825 ml										060190	

* These are SPIT studs, for standard studs (zinc coated or stainless steel versions) see catalogue.

Anchor mechanical properties

Anchor size		M8	M10	M12	M16	M20	M24	M30
SPIT Zinc coated steel stud, grade 5.8								
f_{uk} (N/mm^2)	Min. tensile strength	600	600	600	600	520	520	520
f_{yk} (N/mm^2)	Yield strength	420	420	420	420	420	420	420
$M^0_{rk,s}$ (Nm)	Characteristic bending moment	22	45	79	200	301	520	1052
M (Nm)	Recommended bending moment	11,0	22,5	39,5	100	150	160	525
SPIT Stainless steel stud, A4-70								
f_{uk} (N/mm^2)	Min. tensile strength	700	700	700	700	700	700	-
f_{yk} (N/mm^2)	Yield strength	350	350	350	350	350	350	-
$M^0_{rk,s}$ (Nm)	Characteristic bending moment	26	52	92	233	454	786	-
M (Nm)	Recommended bending moment	12	23	42	122	206	357	-
As (mm^2)	Stressed cross-section	36,6	58	84,3	157	227	326,9	-
W_{el} (mm^3)	Elastic section modulus	31,2	62,3	109,2	277,5	482,4	833,7	-

Setting time

Temperature	Max. time for installation		Curing time	
	Standard version	Tropical version	Standard version	Tropical version
-10°C ▶ -5°C	90 min.	-	24 h	-
-4°C ▶ 0°C	50 min.	-	240 min.	-
1°C ▶ 5°C	25 min.	60 min.	120 min.	240 min.
6°C ▶ 10°C	15 min.	40 min.	90 min.	180 min.
11°C ▶ 20°C	7 min.	15 min.	60 min.	120 min.
21°C ▶ 30°C	4 min.	8 min.	45 min.	60 min.
31°C ▶ 40°C	2 min.	4 min.	30 min.	60 min.

Chemical resistance of the SPIT VIPER resin

Chemical substances	Concentration (%)	Resistance
Acetic acid	50-75	(o)
Acetic acid	0-50	(+)
Acetone	10	(+)
Ammonium hydroxide or Ammoniac	20	(o)
Ammonium hydroxide or Ammoniac	5	(+)
Bromine water	5	(+)
Chlorine water	0-100	(+)
Citric acid	0-100	(+)
Concentrated phosphoric acid	100	(+)
Deionized water	0-100	(+)
Demineralized water		(+)
Diesel fuel	0-100	(+)
Ethyl alcohol (Ethanol)	10	(o)
Ethylene glycol	0-100	(+)
Formic acid	10	(+)
Fuel	100	(+)
Heavy motor oil	100	(+)

Chemical substances	Concentration (%)	Resistance
Heptane	100	(+)
Hexane	100	(o)
Hydrochloric acid	25	(o)
Hydrochloric acid	15	(+)
Lactic acid	0-100	(+)
Nitric acid	feb-15	(o)
Phosphoric acid	80	(+)
Phosphoric acid, vapor and condensed		(+)
Sea water	0-100	(+)
Sodium carbonate	10	(+)
Sodium chloride	0-100	(+)
Sodium hydroxide (or Caustic soda)	25	(o)
Sulfuric acid	71-75	(o)
Sulfuric acid	0-70	(+)
Sulfuric acid	Fumes	(+)
Sulfuric acid / Phosphoric acid	10:20	(+)
Turpentine (oil)		(o)

Resistant (+): the samples in contact with the substances did not show any Screwible 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 (3/10 to 10/10).

Number of sealings per cartridge

Anchor size	M8	M10	M12	M16	M20	M24	M30
Drilling diameter (mm)	10	12	14	18	25	28	35
Drilling depth (mm)	80	90	110	125	170	210	280
Number of sealings per cartridge							
VIPER 825 ml	175	118	77	48	17	11	5
VIPER 410 ml	87	59	38	24	8	5	3
VIPER 280 ml	59	40	26	16	6	4	2

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	M24	M30
Non-cracked concrete (C20/25)							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
$N_{Ru,m}$	40,7	57,3	84,0	107,4	159,4	212,6	308,8
N_{Rk}	32,1	45,2	66,2	84,4	125,8	167,4	243,4
Cracked concrete (C20/25)							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
$N_{Ru,m}$	26,9	35,3	49,0	68,1	108,2	151,7	236,4
N_{Rk}	20,6	27,1	37,6	52,3	83,1	116,6	181,6

SHEAR

Anchor size	M8	M10	M12	M16	M20	M24	M30
Cracked & non-cracked concrete (C20/25)							
$V_{Ru,m}$	15,9	22,7	32,8	56,2	73,6	115,0	177,7
V_{Rk}	11,0	18,9	25,3	46,8	59,0	95,8	135,9

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 (stud grade 10.9)

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

TENSILE

Anchor size	M8	M10	M12	M16	M20	M24	M30
Non-cracked concrete (C20/25)							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
N_{Rd}	21,4	30,1	44,2	56,2	83,8	111,6	162,3
Cracked concrete (C20/25)							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
N_{Rd}	13,8	18,1	25,1	34,9	55,4	77,7	121,1

$\gamma_{Mc} = 1,5$

SHEAR

Anchor size	M8	M10	M12	M16	M20	M24	M30
Cracked & non-cracked concrete (C20/25)							
V_{Rd}	7,7	13,2	17,7	32,7	39,3	63,9	90,6

$\gamma_{Ms} = 1,43$ for M8 to M16 and $\gamma_{Ms} = 1,5$ for M20 to M30

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 (stud grade 10.9)

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

TENSILE

Anchor size	M8	M10	M12	M16	M20	M24	M30
Non-cracked concrete (C20/25)							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
N_{rec}	15,3	21,5	31,5	40,2	59,9	79,7	115,9
Cracked concrete (C20/25)							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
N_{rec}	9,8	12,9	17,9	24,9	39,6	55,5	86,5

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

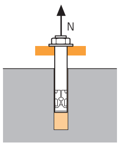
SHEAR

Anchor size	M8	M10	M12	M16	M20	M24	M30
Cracked & non-cracked concrete (C20/25)							
V_{rec}	5,5	9,4	12,6	23,4	28,1	45,6	64,7

$\gamma_F = 1,4$; $\gamma_{Ms} = 1,43$ for M8 to M16 and $\gamma_{Ms} = 1,5$ for M20 to M30

SPIT CC Method (values issued from ETA)

TENSILE in kN



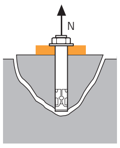
Pull-out resistance for dry and wet concrete [1]

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
Non-cracked concrete	20,1	28,3	41,5	54,5	78,3	105,6	149,5
Cracked concrete	8,7	12,3	18,0	27,2	46,3	68,6	105,6

$\gamma_{Mc} = 1,5$



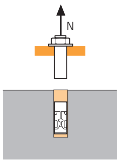
Concrete cone resistance for dry and wet concrete [1]

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
Non-cracked concrete	24,0	28,7	38,8	47,0	74,5	102,3	157,4
Cracked concrete	17,2	20,5	27,7	33,5	53,2	73,0	112,4

$\gamma_{Mc} = 1,5$



Steel resistance

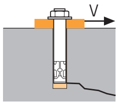
$N_{Rd,s}$ — **Steel design tensile resistance**

Anchor size	M8	M10	M12	M16	M20	M24	M30
Stud Zn. 5.8 grade	12,0	19,3	28,0	52,0	81,3	118,0	186,7
Stud Zn. 8.8 grade*	19,3	30,7	44,7	84,0	130,7	188,0	299,3
Stud Zn. 10.9 grade*	26,4	41,4	60,0	112,1	175,0	252,1	400,7
Stud A4-70	12,3	19,8	28,9	54,5	85,0	122,5	-

Stud Zn. grade 5.8 and 8.8 : $\gamma_{Ms} = 1,5$ and grade 10.9 : $\gamma_{Ms} = 1,4$
Stud A4-70 : $\gamma_{Ms} = 1,87$
* Special grade available on request

[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



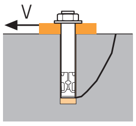
Concrete edge resistance

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
C_{min}	40	45	45	50	55	60	80
S_{min}	40	50	60	75	90	115	140
Non-cracked concrete	2,4	3,6	5,3	9,1	14,4	20,9	33,0
Cracked concrete	1,7	2,6	3,8	6,5	10,3	14,9	23,6

$\gamma_{Mc} = 1,5$



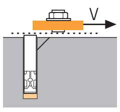
Pryout failure

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
Non-cracked concrete	40,2	56,5	77,5	93,9	149,0	204,5	299,1
Cracked concrete	17,4	24,5	35,9	54,5	92,6	137,2	211,1

$\gamma_{Mcp} = 1,5$



Steel resistance

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
Stud Zn. 5.8 grade	7,4	11,6	16,9	31,2	48,8	70,4	112,0
Stud Zn. 8.8 grade*	11,7	18,6	27,0	50,4	78,4	112,8	179,2
Stud Zn. 10.9 grade*	12,2	19,3	28,1	52,0	81,3	117,3	186,7
Stud A4-70	7,3	11,9	17,3	32,7	51,3	73,1	-

Stud Zn. grade 5.8 and 8.8 : $\gamma_{Ms} = 1,25$ and grade 10.9 : $\gamma_{Ms} = 1,5$
Stud A4-70 : $\gamma_{Ms} = 1,56$
* Special grade available on request

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

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

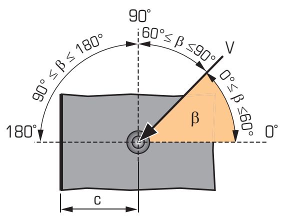
$$\beta_N + \beta_V \leq 1,2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b Non-cracked concrete		f_b Cracked concrete
	M8-M16	M20-M30	M8-M30
C25/30	1,02	1,06	1,00
C30/40	1,05	1,15	1,00
C40/60	1,07	1,23	1,00
C50/60	1,09	1,30	1,00

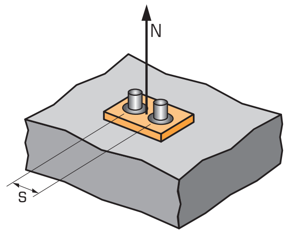
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

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



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

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

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

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

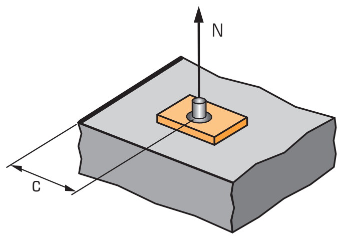
SPACING S — Reduction factor Ψ_s — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16
40	0,58			
50	0,60	0,59		
60	0,63	0,61	0,59	
75	0,66	0,64	0,61	0,60
100	0,71	0,69	0,65	0,63
150	0,81	0,78	0,73	0,70
200	0,92	0,87	0,80	0,77
240	1,00	0,94	0,86	0,82
270		1,00	0,91	0,86
330			1,00	0,94
375				1,00

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

Anchor size	M20	M24	M30
90	0,59		
115	0,61	0,59	
140	0,64	0,61	0,58
180	0,68	0,64	0,61
200	0,70	0,66	0,62
250	0,75	0,70	0,65
350	0,84	0,78	0,71
450	0,94	0,86	0,77
510	1,00	0,90	0,80
630		1,00	0,88
750			0,95
840			1,00

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



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

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

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

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

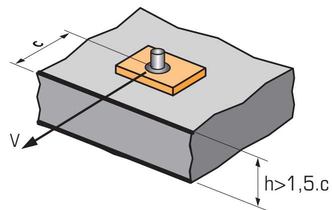
EDGE C — Reduction factor $\Psi_{c,N}$ — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16
40	0,50			
45	0,53	0,50	0,45	
50	0,56	0,53	0,48	0,45
75	0,72	0,67	0,59	0,55
100	0,88	0,81	0,70	0,65
120	1,00	0,92	0,80	0,73
135		1,00	0,86	0,79
165			1,00	0,91
190				1,00

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

Anchor size	M20	M24	M30
55	0,41		
60	0,43	0,39	
80	0,49	0,44	0,39
150	0,69	0,61	0,52
200	0,84	0,73	0,61
255	1,00	0,86	0,71
315		1,00	0,81
420			1,00

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

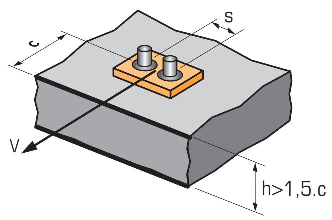


$$\Psi_{s\text{-}c,V} = \frac{c}{c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

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

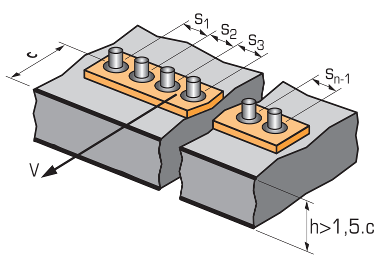


$$\Psi_{s\text{-}c,V} = \frac{3.c + s}{6.c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

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

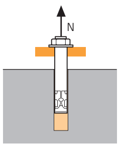


For 3 anchors fastening and more

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

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

TENSILE in kN



Pull-out resistance

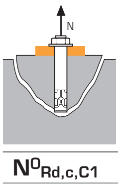
$N_{Rd,p,C1} = N^{0}_{Rd,p,C1} \cdot f_b$

$N^{0}_{Rd,p,C1}$ — Design pull-out resistance

Anchor size	M8	M10	M12	M16	M20	M24	M30
Category C1 - Single anchor							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
$N^{0}_{Rd,p,C1}$ (C20/25)	8,0	11,6	18,0	25,6	44,4	68,6	105,6
Category C1 - Group of anchors [1]							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
$N^{0}_{Rd,p,C1}$ (C20/25)	6,8	9,9	15,3	21,8	37,8	58,3	89,7

[1] when more than one anchor of the group is submitted to tensile load

$\gamma_{Mc} = 1,5$



Concrete cone resistance

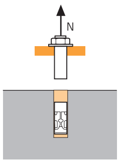
$N_{Rd,c,C1} = N^{0}_{Rd,c,C1} \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$

$N^{0}_{Rd,c,C1}$ — Design cone resistance

Anchor size	M8	M10	M12	M16	M20	M24	M30
Category C1 - Single anchor							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
$N^{0}_{Rd,c,C1}$ (C20/25)	14,6	17,4	23,5	28,5	45,2	62,1	95,6
Category C1 - Group of anchors [1]							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
$N^{0}_{Rd,c,C1}$ (C20/25)	12,9	15,4	20,8	25,2	39,9	54,8	84,3

[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	M24	M30
Stud Zn. 5.8 grade	12,0	19,3	28,0	52,0	81,3	118,0	186,7
Stud Zn. 8.8 grade*	19,3	30,7	44,7	84,0	130,7	188,0	299,3
Stud Zn. 10.9 grade*				NA			
Stud A4-70	12,3	19,8	28,9	54,5	85,0	122,5	-

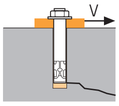
Stud Zn. grade 5.8 and 8.8 : $\gamma_{Ms} = 1,5$

Stud A4-70 : $\gamma_{Ms} = 1,87$

* Special grade available on request

[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

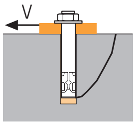
$V_{Rd,c,C1} = V^{0}_{Rd,c,C1} \cdot f_b \cdot f_{\beta,V} \cdot \Psi_{S-C,V}$

$V^{0}_{Rd,c,C1}$ — Design concrete edge resistance at minimum edge distance (C_{min})

Anchor size	M8	M10	M12	M16	M20	M24	M30
Category C1 - Single anchor							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
C_{min}	40	45	45	50	55	60	80
S_{min}	40	45	45	75	90	115	140
$V^{0}_{Rd,c,C1}$ (C20/25)	1,7	2,6	3,8	6,5	10,3	14,9	23,6
Category C1 - Group of anchors [1]							
h_{ef}	80	90	110	125	170	210	280
C_{min}	40	45	45	50	55	60	80
S_{min}	40	45	45	75	90	115	140
$V^{0}_{Rd,c,C1}$ (C20/25)	1,4	2,2	3,2	5,5	8,7	12,7	20,1

[1] when more than one anchor of the group is submitted to shear load

$\gamma_{Mc} = 1,5$



Pryout failure

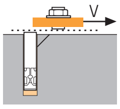
$V_{Rd,cp,C1} = V^{0}_{Rd,cp,C1} \cdot f_b \cdot \Psi_s \cdot \Psi_{c,N}$

$V^{0}_{Rd,cp,C1}$ — Design pryout resistance

Anchor size	M8	M10	M12	M16	M20	M24	M30
Category C1 - Single anchor							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
$V^{0}_{Rd,cp,C1}$ (C20/25)	29,2	34,8	47,1	57,0	90,4	124,2	191,2
Category C1 - Group of anchors [1]							
h_{ef}	80	90	110	125	170	210	280
$V^{0}_{Rd,cp,C1}$ (C20/25)	25,8	30,7	41,5	50,3	79,8	109,6	168,7

[1] when more than one anchor of the group is submitted to shear load

$\gamma_{Mc} = 1,5$



Steel resistance [1]

$V^{0}_{Rd,cp,C1}$ — Steel design shear resistance

Anchor size	M8	M10	M12	M16	M20	M24	M30
Category C1 - Single anchor							
Stud Zn. 5.8 grade	5,2	8,1	11,8	21,8	34,2	49,3	78,4
Stud Zn. 8.8 grade*	11,7	18,6	27,0	50,4	78,4	112,8	179,2
Category C1 - Group of anchors [1]							
Stud Zn. 5.8 grade	4,4	6,9	10,0	18,6	29,0	41,9	66,6
Stud Zn. 8.8 grade*	9,9	15,8	22,9	42,8	66,6	95,9	152,3

[1] when more than one anchor of the group is submitted to shear load

Stud Zn. grade 5.8 and 8.8 : $\gamma_{Mc} = 1,25$

* Special grade available on request.

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

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

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

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

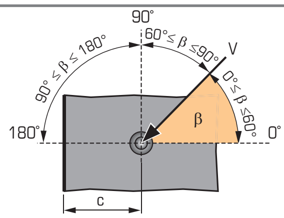
$$\beta_N + \beta_V \le 1,2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b Non-cracked concrete		f_b Cracked concrete
	M8-M16	M20-M30	M8-M30
C25/30	1,02	1,06	1,00
C30/40	1,05	1,15	1,00
C40/60	1,07	1,23	1,00
C50/60	1,09	1,30	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

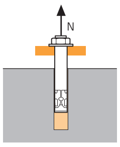


Material properties for SPIT VIPER XTREM Adhesive

Test Method	Performance	Test report	Testing Conditions
Contact with water for domestic purposes.	Suitable	WRAS APPROVAL NUMBER: 1710516	BS6920-1:2000 and/or 2014
EMISSION OF VOLATILE ORGANIC COMPOUNDS (VOC)	Classification A+	Test certificate N° CTEST165196	ISO 16000
Compressive strength	62 MPa	CEDRE Lab Test report n° 37091	ASTM D695 Cylinder specimens : Ø25 mm 50 mm ; cured 24 h at 20°C
Elasticity modulus in tensile Tensile strength	4.23 GPa 12.1 MPa	Rescoll Lab Test report n° 1702351	NF EN ISO 527-2 Specimens cured 24 h at 20°C/50%HR
Elasticity modulus in flexure Flexural strength	6.29 GPa 33 MPa		ISO 14125 Specimens cured 24 h at 20°C/50%HR
Linear coefficient of shrinkage	1µm/mm	Nelson Lab Test report 17-1328	ASTM D2566 Specimens cured 24 h at 20°C/50%HR
Volume resistivity	2.10^{11} Ω.cm	LCIE Lab Test report n°151350-711426 VIPER XTREM is in the insulating category	IEC62631-3-1:2016 Test conditions : 25°C/50%HR Test voltage: 500Vdc
Permittivity	12,5		IEC60250:1969 Test conditions : 25°C/50%HR Test voltage: 20 V rms
Dilectric dissipation factor	0,264		

SPIT CC Method (values issued from ETA)

TENSILE in kN



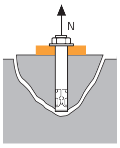
Pull-out resistance for dry and wet concrete [1]

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**95**	**120**	**144**	**192**	**220**	**280**	**330**
Non-cracked concrete	23,9	37,7	54,3	83,6	101,4	140,7	176,2
Cracked concrete	10,3	16,3	23,5	41,8	59,9	91,5	124,4

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



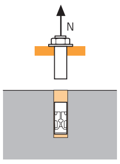
Concrete cone resistance for dry and wet concrete [1]

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

$N^0_{Rd,c}$ — Design cone resistance

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**95**	**120**	**144**	**192**	**220**	**280**	**330**
Non-cracked concrete	31,1	44,2	58,1	89,4	109,6	157,4	201,4
Cracked concrete	22,2	31,5	41,5	63,9	78,3	112,4	143,9

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



Steel resistance

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
Stud Zn. 5.8 grade	12,0	19,3	28,0	52,0	81,3	118,0	186,7
Stud Zn. 8.8 grade*	19,3	30,7	44,7	84,0	130,7	188,0	299,3
Stud Zn. 10.9 grade*	26,4	41,4	60,0	112,1	175,0	252,1	400,7
Stud A4-70	12,3	19,8	28,9	54,5	85,0	122,5	-

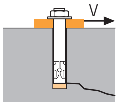
Stud Zn. grade 5.8 and 8.8 : $\gamma_{Ms} = 1{,}5$ and grade 10.9 : $\gamma_{Ms} = 1{,}4$

Stud A4-70 : $\gamma_{Ms} = 1{,}87$

* Special grade available on request

[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



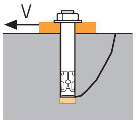
Concrete edge resistance

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**95**	**120**	**144**	**192**	**220**	**280**	**330**
C_{min}	40	45	45	50	55	60	80
S_{min}	40	45	45	75	90	115	140
Non-cracked concrete	2,5	3,3	3,6	4,9	6,2	7,8	13,3
Cracked concrete	1,8	2,4	2,6	3,5	4,4	5,6	9,5

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



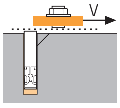
Pryout failure

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**95**	**120**	**144**	**192**	**220**	**280**	**330**
Non-cracked concrete	47,8	75,4	108,6	167,3	202,7	281,5	352,5
Cracked concrete	20,7	32,7	47,0	83,6	119,8	183,0	248,8

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



Steel resistance

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
Stud Zn. 5.8 grade	7,4	11,6	16,9	31,2	48,8	70,4	112,0
Stud Zn. 8.8 grade*	11,7	18,6	27,0	50,4	78,4	112,8	179,2
Stud Zn. 10.9 grade*	12,2	19,3	28,1	52,0	81,3	117,3	186,7
Stud A4-70	7,3	11,9	17,3	32,7	51,3	73,1	-

Stud Zn. grade 5.8 and 8.8 : $\gamma_{Ms} = 1{,}25$ and grade 10.9 : $\gamma_{Ms} = 1{,}5$

Stud A4-70 : $\gamma_{Ms} = 1{,}56$

* Special grade available on request

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

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

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

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

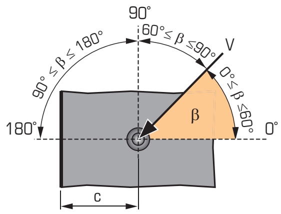
$$\beta_N + \beta_V \leq 1{,}2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b Non-cracked concrete		f_b Cracked concrete
	M8-M16	M20-M30	M8-M30
C25/30	1,02	1,06	1,00
C30/40	1,05	1,15	1,00
C40/60	1,07	1,23	1,00
C50/60	1,09	1,30	1,00

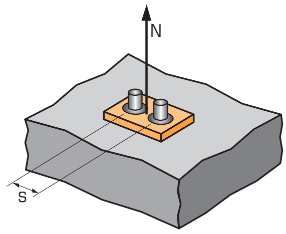
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

Angle β [°]	$f_{\beta,V}$
0 to 5	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



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

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

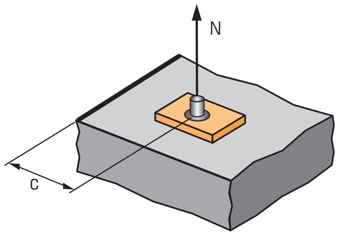
$s_{cr,N} = 3.h_{ef}$

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**
40	0,57			
50	0,59	0,57		
60	0,61	0,58	0,57	
75	0,63	0,60	0,59	0,57
100	0,68	0,64	0,62	0,59
150	0,76	0,71	0,67	0,63
200	0,85	0,78	0,73	0,67
290	1,00	0,90	0,84	0,75
360		1,00	0,92	0,81
435			1,00	0,88
580				1,00

SPACING S	Reduction factor Ψ_s Cracked & non-cracked concrete		
Anchor size	**M20**	**M24**	**M30**
90	0,57		
115	0,59	0,57	
140	0,61	0,58	0,57
180	0,64	0,61	0,59
200	0,65	0,62	0,60
250	0,69	0,65	0,63
300	0,73	0,68	0,65
400	0,80	0,74	0,70
500	0,88	0,80	0,75
660	1,00	0,89	0,83
840		1,00	0,92
990			1,00

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



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

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

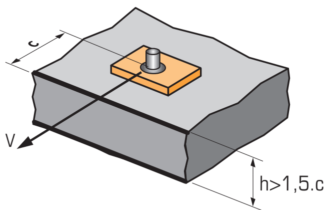
$c_{cr,N} = 1,5.h_{ef}$

$\Psi_{c,N}$ 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**
40	0,46			
45	0,49	0,44	0,41	
50	0,51	0,46	0,42	0,38
75	0,64	0,56	0,51	0,45
145	1,00	0,85	0,75	0,63
180		1,00	0,88	0,72
215			1,00	0,81
290				1,00

EDGE C	Reduction factor $\Psi_{c,N}$ Cracked & non-cracked concrete		
Anchor size	**M20**	**M24**	**M30**
55	0,38		
60	0,39	0,36	
80	0,43	0,39	0,37
200	0,70	0,61	0,55
250	0,82	0,70	0,63
330	1,00	0,84	0,75
420		1,00	0,89
500			1,00

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

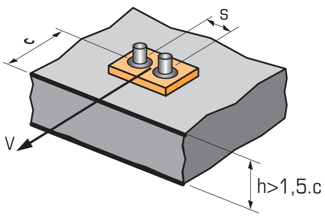


$$\Psi_{s\text{-}c,V} = \frac{c}{c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

For single anchor fastening

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

$\frac{C}{C_{min}}$	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

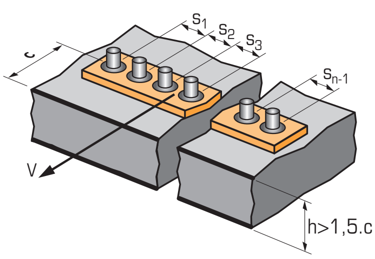


$$\Psi_{s\text{-}c,V} = \frac{3.c + s}{6.c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

For 2 anchors fastening

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

$\frac{S}{C_{min}}$ \ $\frac{C}{C_{min}}$	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

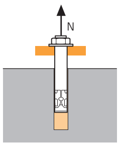


For 3 anchors fastening and more

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

SPIT CC Method (values issued from ETA)

TENSILE in kN



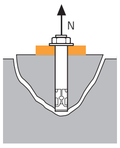
Pull-out resistance for dry and wet concrete [1]

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

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

Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**128**	**160**	**192**	**256**	**320**	**384**
Non-cracked concrete	32,2	50,3	72,4	111,5	147,4	193,0
Cracked concrete	13,9	21,8	31,4	55,8	87,1	125,5

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



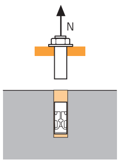
Concrete cone resistance for dry and wet concrete [1]

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

$N^0_{Rd,c}$ — Design cone resistance

Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**128**	**160**	**192**	**256**	**320**	**384**
Non-cracked concrete	48,7	68,0	89,4	137,6	192,3	252,8
Cracked concrete	34,8	48,6	63,9	98,3	137,4	180,6

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



Steel resistance

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

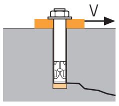
Anchor size	M8	M10	M12	M16	M20	M24
Stud Zn. 5.8 grade	12,0	19,3	28,0	52,0	81,3	118,0
Stud Zn. 8.8 grade*	19,3	30,7	44,7	84,0	130,7	188,0
Stud Zn. 10.9 grade*	26,4	41,4	60,0	112,1	175,0	252,1

Stud Zn. grade 5.8 and 8.8 : $\gamma_{Ms} = 1{,}5$ and grade 10.9 : $\gamma_{Ms} = 1{,}4$

* Special grade available on request.

[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



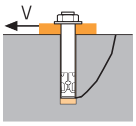
Concrete edge resistance

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

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

Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**128**	**160**	**192**	**256**	**320**	**384**
C_{min}	40	45	45	50	55	60
S_{min}	40	45	45	75	90	115
Non-cracked concrete	2,6	3,5	5,2	7,7	12,8	19,3
Cracked concrete	1,9	2,5	3,7	5,5	9,2	13,8

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



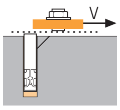
Pryout failure

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

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

Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**128**	**160**	**192**	**256**	**320**	**384**
Non-cracked concrete	64,3	100,5	144,8	223,0	294,9	386,0
Cracked concrete	27,9	43,6	62,7	111,5	174,3	250,9

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



Steel resistance

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

Anchor size	M8	M10	M12	M16	M20	M24
Stud Zn. 5.8 grade	7,4	11,6	16,9	31,2	48,8	70,4
Stud Zn. 8.8 grade*	11,7	18,6	27,0	50,4	78,4	112,8
Stud Zn. 10.9 grade*	12,2	19,3	28,1	52,0	81,3	117,3

Stud Zn. grade 5.8 and 8.8 : $\gamma_{Ms} = 1{,}25$ and grade 10.9 : $\gamma_{Ms} = 1{,}5$

* Special grade available on request.

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

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

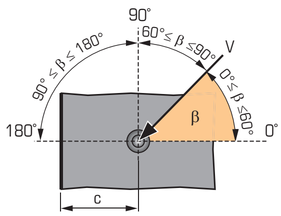
$$\beta_N + \beta_V \leq 1{,}2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b Non-cracked concrete		f_b Cracked concrete
	M8-M16	M20-M30	M8-M30
C25/30	1,02	1,06	1,00
C30/40	1,05	1,15	1,00
C40/60	1,07	1,23	1,00
C50/60	1,09	1,30	1,00

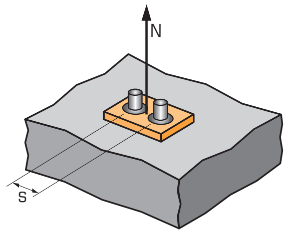
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

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



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

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

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

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

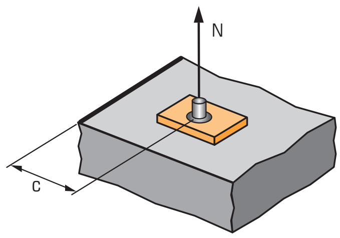
SPACING S — Reduction factor Ψ_s — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16
40	0,55			
50	0,57	0,55		
60	0,58	0,56	0,55	0,54
75	0,60	0,58	0,57	0,55
120	0,66	0,63	0,60	0,58
200	0,76	0,71	0,67	0,63
250	0,83	0,76	0,72	0,66
385	1,00	0,90	0,83	0,75
480		1,00	0,92	0,81
580			1,00	0,88
770				1,00

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

Anchor size	M20	M24
90	0,55	
115	0,56	0,55
140	0,57	0,56
250	0,63	0,61
350	0,68	0,65
550	0,79	0,74
650	0,84	0,78
750	0,89	0,83
850	0,94	0,87
960	1,00	0,92
1150		1,00

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



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

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

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

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

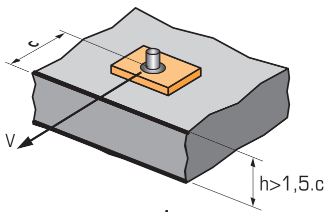
EDGE C — Reduction factor $\Psi_{c,N}$ — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16
40	0,41			
45	0,43	0,39	0,37	
50	0,45	0,41	0,38	0,35
75	0,54	0,48	0,45	0,40
190	0,99	0,84	0,74	0,62
240		1,00	0,88	0,72
290			1,00	0,82
385				1,00

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

Anchor size	M20	M24
55	0,34	
60	0,34	0,33
80	0,38	0,35
250	0,64	0,58
300	0,72	0,64
480	1,00	0,88
580		1,00

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

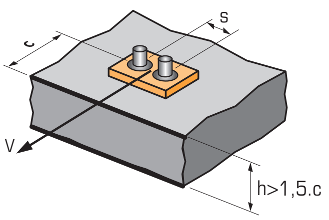


$$\Psi_{s-c,V} = \frac{c}{c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

For single anchor fastening

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

$\frac{C}{C_{min}}$	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

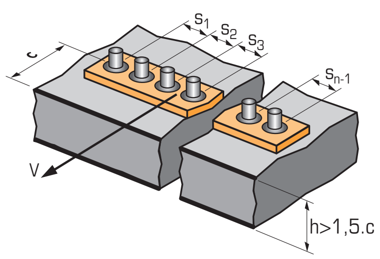


$$\Psi_{s-c,V} = \frac{3.c + s}{6.c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

For 2 anchors fastening

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

$\frac{S}{C_{min}}$ \ $\frac{C}{C_{min}}$	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



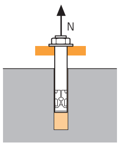
For 3 anchors fastening and more

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

Chemical anchors

SPIT CC Method (values issued from ETA)

TENSILE in kN



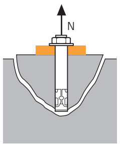
Pull-out resistance for dry and wet concrete [(1)]

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

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

Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**160**	**200**	**240**	**320**	**400**	**480**
Non-cracked concrete	40,2	62,8	90,5	139,4	184,3	241,3
Cracked concrete	17,4	27,2	39,2	69,7	108,9	156,8

$\gamma_{Mc} = 1,5$



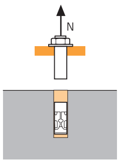
Concrete cone resistance for dry and wet concrete [(1)]

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

$N^0_{Rd,c}$ — Design cone resistance

Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**160**	**200**	**240**	**320**	**400**	**480**
Non-cracked concrete	68,0	95,0	124,9	192,3	268,8	353,3
Cracked concrete	48,6	67,9	89,2	137,4	192,0	252,4

$\gamma_{Mc} = 1,5$



Steel resistance

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

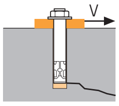
Anchor size	M8	M10	M12	M16	M20	M24
Stud Zn. 5.8 grade	12,0	19,3	28,0	52,0	81,3	118,0
Stud Zn. 8.8 grade*	19,3	30,7	44,7	84,0	130,7	188,0
Stud Zn. 10.9 grade*	26,4	41,4	60,0	112,1	175,0	252,1

Stud Zn. grade 5.8 and 8.8 : $\gamma_{Ms} = 1,5$ and grade 10.9 : $\gamma_{Ms} = 1,4$

* Special grade available on request

[(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



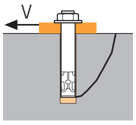
Concrete edge resistance

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

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

Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**160**	**200**	**240**	**320**	**400**	**480**
C_{min}	40	45	45	50	55	60
S_{min}	40	45	45	75	90	115
Non-cracked concrete	2,7	3,6	5,4	8,0	13,4	20,2
Cracked concrete	2,0	2,6	3,9	5,7	9,6	14,4

$\gamma_{Mc} = 1,5$



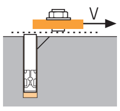
Pryout failure

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

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

Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**160**	**200**	**240**	**320**	**400**	**480**
Non-cracked concrete	80,4	125,7	181,0	278,8	368,6	482,5
Cracked concrete	34,9	54,5	78,4	139,4	217,8	313,7

$\gamma_{Mcp} = 1,5$



Steel resistance

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

Anchor size	M8	M10	M12	M16	M20	M24
Stud Zn. 5.8 grade	7,4	11,6	16,9	31,2	48,8	70,4
Stud Zn. 8.8 grade*	11,7	18,6	27,0	50,4	78,4	112,8
Stud Zn. 10.9 grade*	12,2	19,3	28,1	52,0	81,3	117,3

Stud Zn. grade 5.8 and 8.8 : $\gamma_{Ms} = 1,25$ and grade 10.9 : $\gamma_{Ms} = 1,5$

* Special grade available on request

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

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

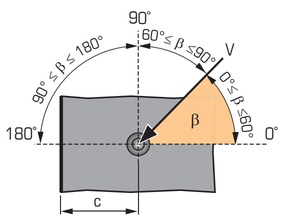
$$\beta_N + \beta_V \leq 1,2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b Non-cracked concrete		f_b Cracked concrete
	M8-M16	M20-M30	M8-M30
C25/30	1,02	1,06	1,00
C30/37	1,05	1,15	1,00
C40/50	1,07	1,23	1,00
C50/60	1,09	1,30	1,00

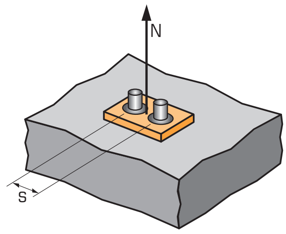
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

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



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

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

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

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

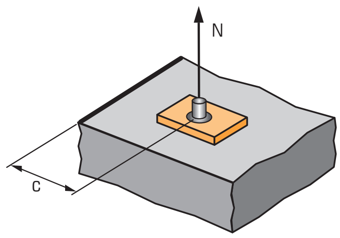
SPACING S — Reduction factor Ψ_s — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16
50	0,55	0,54		
60	0,56	0,55	0,54	0,53
75	0,58	0,56	0,55	0,54
150	0,66	0,63	0,60	0,58
250	0,76	0,71	0,67	0,63
350	0,86	0,79	0,74	0,68
480	1,00	0,90	0,83	0,75
600		1,00	0,92	0,81
720			1,00	0,88
960				1,00

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

Anchor size	M20	M24
90	0,54	
115	0,55	0,54
140	0,56	0,55
250	0,60	0,59
350	0,65	0,62
450	0,69	0,66
600	0,75	0,71
800	0,83	0,78
1000	0,92	0,85
1200	1,00	0,92
1450		1,00

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



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

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

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

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

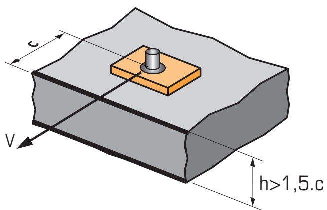
EDGE C — Reduction factor $\Psi_{c,N}$ — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16
40	0,38			
45	0,39	0,36	0,34	
50	0,41	0,38	0,35	0,33
75	0,48	0,44	0,41	0,37
240	1,00	0,85	0,75	0,63
300		1,00	0,88	0,72
360			1,00	0,81
480				1,00

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

Anchor size	M20	M24
55	0,32	
60	0,33	0,31
80	0,35	0,33
250	0,56	0,51
400	0,75	0,67
600	1,00	0,88
720		1,00

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

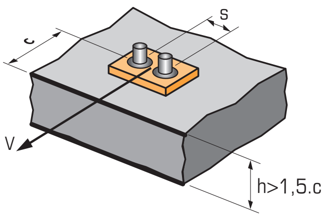


$$\Psi_{s\text{-}c,V} = \frac{c}{c_{min}} \,.\, \sqrt{\frac{c}{c_{min}}}$$

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

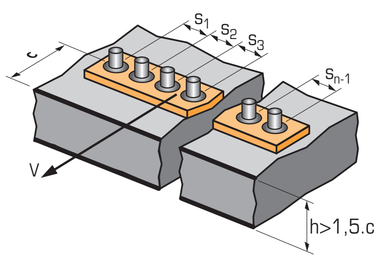


$$\Psi_{s\text{-}c,V} = \frac{3.c + s}{6.c_{min}} \,.\, \sqrt{\frac{c}{c_{min}}}$$

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

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

Chemical anchors