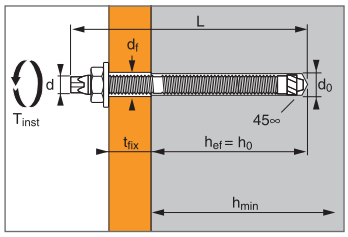





ETA European Technical Approval

SOCOTEC

ETA Option 7 n° QX 0070
n° 05/0111



Applications

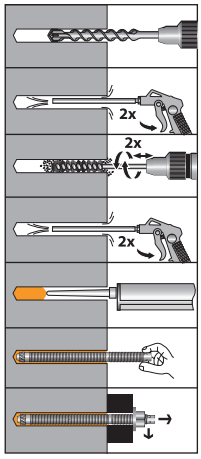
- Fixing steel framed structures
- Fixing machinery (resistant to vibration)
- Fixing of storage silos, refinery pipework supports
- Fixing motorway signs
- Fixing safety barriers

Material

- **Threaded rod M8-M16:** Cold formed steel NF A35-053
- **Threaded rod M20-M30:** 11 SMnPb37 - NFA 35-561
- **Nut:** Steel, EN 20898-2 grade 6 or 8
- **Washer:** Steel DIN 513
- **Zinc coating 5 µm min.** NF E25-009

Installation

Premium cleaning*



***Premium cleaning:**

- Blow with compressed air X2
- Clean with a brush attached to a drilling machine X2
- Blow with compressed air X2

Vinylester chemical resin - high performance

Technical data

SPIT EPOMAX resin with Zinc coated steel MAXIMA rod	Max. anchor depth (mm)	Max. thick of part to be fixed (mm)	Min thick of base material (mm)	Ø thread (mm)	Drilling depth (mm)	Ø drill bit (mm)	Ø clearance (mm)	Total rod length (mm)	Max. tighten torque (Nm)	Eurocode
	h_{ef}	t_{fix}	h_{min}	d	h_o	d_o	d_f	L	T_{inst}	
EPOMAX M8	80	15	110	8	80	10	9	110	10	050950
EPOMAX M10	90	20	120	10	90	12	12	130	20	050960
EPOMAX M12	110	25	140	12	110	14	14	160	30	050970
EPOMAX M16	125	35	160	16	125	18	18	190	60	050980
EPOMAX M20	170	65	220	20	170	25	22	260	120	655220
EPOMAX M24	210	63	265	24	210	28	26	300	200	655240
EPOMAX M30	280	70	350	30	280	35	33	380	400	050940
EPOMAX Dual component cartridge vinylester resin					- vol. 150 ml					050883
					- vol. 345 ml					050884
					- vol. 380 ml					050885

Anchor mechanical properties

Threaded part (Maxima Rod)		M8	M10	M12	M16	M20	M24	M30
f_{uk} (N/mm²)	Min. tensile strength	600	600	600	600	520	520	520
f_{yk}(N/mm²)	Yield strength	420	420	420	420	420	420	420
As (mm²)	Stressed cross-section	36,6	58	84,3	157	227	326,9	522,8
W_{el} (mm³)	Elastic section modulus	31,2	62,3	109,2	277,5	482,4	833,7	1686,0
$M^0_{Rk,s}$ (Nm)	Characteristic bending moment	22	45	78	200	301	520	1052
M (Nm)	Recommended bending moment	9,0	18,4	31,8	81,6	122,9	212,2	429,4

Working time and curing time

Ambient temperature (°C)	Torque time	Curing time	
		Dry concrete	Wet concrete
40°C	1 min	30 min	60 min
30°C	3 min	35 min	1 hour 10 min
20°C	6 min	40 min	1 hour 20 min
10°C	11 min	60 min	2 hours
0°C	22 min	3 hours 30 min	7 hours

Note: minimum installation temperature: -5°C

Chemical resistance of the SPIT EPOMAX 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 visible 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 are derived from internal test results. For results derived from CC Methodology, please see overleaf. The data given in the pages "CC - Method" have to be applied.

Number of fixings per cartridge

Anchor size	8	10	12	16	20	24	30
Drilling Ø (mm)	10	12	14	18	25	28	35
Drilling depth (mm)	80	90	110	125	170	210	280
Number of fixings for one cartridge							
EPOMAX 380 ml	140	102	70	47	11	9	4
EPOMAX 345 ml	127	92	64	43	10	8	4
EPOMAX 150 ml	55	40	28	19	4	4	2

Ultimate ($N_{Ru,m}$, $V_{Ru,m}$) / 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
h_{ef}	*80*	*90*	*110*	*125*	*170*	*210*	*280*
$N_{Ru,m}$	29,9	42,5	57,8	79,5	90,8	175,3	219,2
N_{Rk}	22,1	31,1	45,6	61,6	73,7	109,3	147,8

SHEAR

Anchor size	M8	M10	M12	M16	M20	M24	M30
$V_{Ru,m}$	15.92	22.75	32.8	56.2	73.6	115.0	177.7
V_{Rk}	10.98	18.9	25.3	46.8	59.02	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

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

TENSILE

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	*80*	*90*	*110*	*125*	*170*	*210*	*280*
N_{Rd}	14,7	20,7	30,4	41,1	49,1	72,8	98,5

γ_{Mc} = 1,5

SHEAR

Anchor size	M8	M10	M12	M16	M20	M24	M30
V_{Rd}	7.7	13.2	17.7	32.7	39.3	63.9	90.6

γ_{Ms} = 1.43 for M8 to M16 and γ_{Ms} = 1.5 for M20 to M30

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

$$N_{Rec} = \frac{N_{Rk}^{*}}{\gamma_{M}\gamma_{F}}$$

*Derived from test results

$$V_{Rec} = \frac{V_{Rk}^{*}}{\gamma_{M}.\gamma_{F}}$$

TENSILE

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	*80*	*90*	*110*	*125*	*170*	*210*	*280*
N_{Rec}	10,5	14,8	21,7	29,3	35,1	52,0	70,4

γ_F = 1,4 ; γ_{Mc} = 1,5

SHEAR

Anchor size	M8	M10	M12	M16	M20	M24	M30
V_{Rec}	5.5	9.4	12.6	23.4	28.1	45.6	64.7

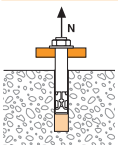
γ_F = 1.4 ; γ_{Ms} = 1.43 for M8 to M16 and γ_{Ms} = 1.5 for M20 to M30






SPIT CC - Method (values issued from ETA)

TENSILE in kN

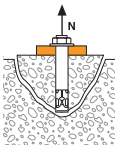


Pull out resistance for dry, wet (1) **concrete with premium cleaning**

$$N_{Rd,p} = N^{O}_{Rd,p} . f_b$$

$N^0_{Rd,p}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design pull-out resistance						
h_{ef}	*80*	*90*	*110*	*125*	*170*	*210*	*280*
-40°C to +40°C	13,3	20,0	26,7	33,3	50,0	63,3	93,3
-40°C to +80°C	10,7	16,7	23,3	26,7	40,0	50,0	76,7
-40°C to +120°C	8,0	13,3	16,7	20,0	30,0	40,0	50,0

$\gamma_{Mc} = 1,5$

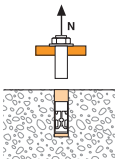


Concrete cone resistance for dry, wet (1) **concrete with premium cleaning**

$$N_{Rd,c} = N^{O}_{Rd,c} . f_b . \Psi_s . \Psi_{c,N}$$

$N^0_{Rd,p}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design cone resistance						
h_{ef}	*80*	*90*	*110*	*125*	*170*	*210*	*280*
-40°C to +40°C	13,3	20,0	26,7	33,3	50,0	63,3	93,3
-40°C to +80°C	10,7	16,7	23,3	26,7	40,0	50,0	76,7
-40°C to +120°C	8,0	13,3	16,7	20,0	30,0	40,0	50,0

$\gamma_{Mc} = 1,5$

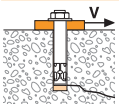


Steel resistance

$N_{Rd,s}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design steel tensile resistance						
SPIT MAXIMA rod	12,9	20,5	29,8	55,6	79,2	114,1	182,6
Std. rod grade 5.8*	12,0	19,3	28,0	52,0	81,3	118,0	186,7
Std. rod grade 8.8*	19,3	30,7	44,7	84,0	130,7	188,0	299,3
Std. rod grade 10.9*	26,4	41,4	60,0	112,1	175,0	252,1	400,7

MAXIMA rod : $\gamma_{Ms} = 1,71$ for M8 to M16 and $\gamma_{Ms} = 1,49$ for M20 to M30
Std. rod grade 5.8 and 8.8 : $\gamma_{Ms} = 1,5$
Std. rod grade 10.9 : $\gamma_{Ms} = 1,4$

SHEAR in kN

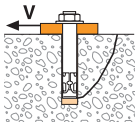


Concrete edge resistance

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

$V^0_{Rd,c}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design concrete edge resistance at minimum edge distance (C_{min})						
h_{ef}	*80*	*90*	*110*	*125*	*170*	*210*	*280*
C_{min}	40	45	55	65	85	105	140
S_{min}	40	45	55	65	85	105	140
$V^0_{Rd,c}$	2,5	3,3	4,8	6,9	12,1	17,9	31,2

$\gamma_{Mc} = 1,5$

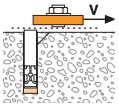


Pryout failure

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

$V^0_{Rd,cp}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design pryout resistance						
h_{ef}	*80*	*90*	*110*	*125*	*170*	*210*	*280*
-40°C to +40°C	26,7	40,0	53,3	66,7	100,0	126,7	186,7
-40°C to +80°C	21,3	33,3	46,7	53,3	80,0	100,0	153,3
-40°C to +120°C	16,0	26,7	33,3	40,0	60,0	80,0	100,0

$\gamma_{Mcp} = 1,5$



Steel resistance

$V_{Rd,s}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design steel shear resistance						
SPIT MAXIMA rod	7,7	12,2	17,7	32,9	39,3	56,7	90,7
Std. rod grade 5.8*	7,36	11,6	16,9	31,2	48,8	70,4	112,0
Std. rod grade 8.8*	11,68	18,6	27,0	50,4	78,4	112,8	179,2
Std. rod grade 10.9*	12,2	19,3	28,1	52,0	81,3	117,3	186,7

MAXIMA rod : $\gamma_{Ms} = 1,43$ for M8 to M16 and $\gamma_{Ms} = 1,5$ for M20 to M30
Std. rod grade 5.8 and 8.8 : $\gamma_{Ms} = 1,25$
Std. rod grade 10.9 : $\gamma_{Ms} = 1,5$

* 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.

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

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

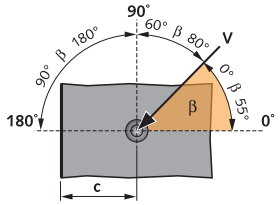
$$\beta_N + \beta_V \leq 1.2$$

f_B Influence of Concrete

Concrete class	f_B
C25/30	1.1
C30/40	1.14
C40/60	1.26
C50/60	1.34

$f_{\beta,V}$ 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

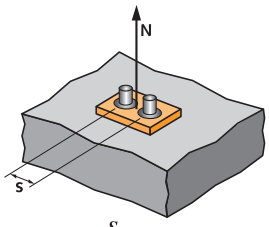







SPIT CC - Method (values issued from ETA)

Ψ_s Influence of spacing for concrete cone resistance in tensile load



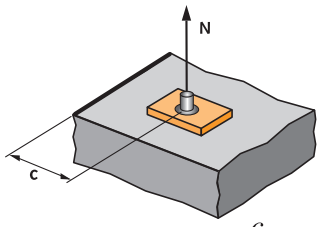
$$\Psi_S = 0{,}5 + \frac{s}{4.h_{ef}}$$

$S_{min} < S < S_{cr,N}$
$S_{cr,N} = 2.h_{ef}$
Ψ_s must be used for each spacing influenced the anchors group.

SPACING S	Reduction factor Ψ_s Non-cracked concrete			
	M8	M10	M12	M16
40	0,63			
45	0,64	0,63		
55	0,67	0,65	0,63	0,61
65	0,70	0,68	0,65	0,63
85	0,77	0,74	0,69	0,67
105	0,83	0,79	0,74	0,71
140	0,94	0,89	0,82	0,78
160	1,00	0,94	0,86	0,82
180		1,00	0,91	0,86
220			1,00	0,94
250				1,00

SPACING S	Reduction factor Ψ_s Non-cracked concrete		
	M20	M24	M30
85	0,63		
105	0,65	0,63	
140	0,71	0,67	0,63
160	0,74	0,69	0,64
180	0,76	0,71	0,66
220	0,82	0,76	0,70
250	0,87	0,80	0,72
300	0,94	0,86	0,77
340	1,00	0,90	0,80
370		0,94	0,83
450		1,00	0,90
560			1,00

$\Psi_{c,N}$ Influence of edge for concrete cone resistance in tensile load



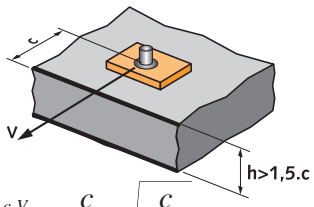
$$\Psi_{c,N} = 0{,}27 + 0{,}725 \cdot \frac{c}{h_{ef}}$$

$C_{min} < C < C_{cr,N}$
$C_{cr,N} = h_{ef}$
$\Psi_{c,N}$ must be used for each distance influenced the anchors group.

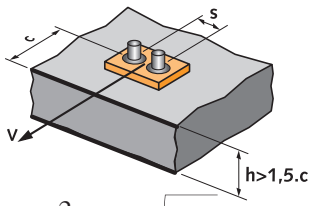
EDGE C	Reduction factor $\Psi_{c,N}$ Non-cracked concrete			
	M8	M10	M12	M16
40	0,63			
45	0,68	0,63		
55	0,77	0,71	0,63	
65	0,86	0,79	0,70	0,66
85	1,00	0,95	0,83	0,76
90		1,00	0,86	0,79
110			1,00	0,91
125				1,00

EDGE C	Reduction factor $\Psi_{c,N}$ Non-cracked concrete		
	M20	M24	M30
85	0,63		
105	0,72	0,63	
120	0,78	0,68	
140	0,87	0,75	0,63
170	1,00	0,86	0,71
210		1,00	0,81
250			0,92
280			1,00

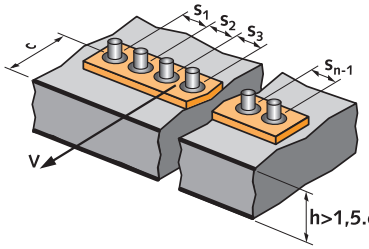
$\Psi_{s-c,V}$ Influence of spacing and edge distance for concrete edge resistance in shear load



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



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



For single anchor fastening

Factor $\Psi_{s-c,V}$ 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

For 2 anchors

Factor $\Psi_{s-c,V}$ 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 or more

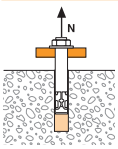
$$\Psi_{s-c,V} = \frac{3.c + s_1 + s_2 + s_3 + \ldots + s_{n-1}}{3\,n\,c} \cdot \sqrt{\frac{c}{c}}$$






SPIT CC - Method (values issued from ETA)

TENSILE in kN

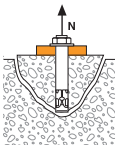


Pull out resistance for dry, wet (1) concrete with premium cleaning

$$N_{Rd,p} = N^{O}_{Rd,p} . f_b$$

$N^0_{Rd,p}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design pull-out resistance						
h_{ef}	*95*	*120*	*144*	*192*	*220*	*280*	*330*
-40°C to +40°C	16,7	26,7	40,0	50,0	63,3	93,3	113,3
-40°C to +80°C	13,3	20,0	26,7	33,3	50,0	53,2	64,8
-40°C to +120°C	10,7	16,7	23,3	33,3	40,0	50,0	63,3

γ_{Mc} = 1,5

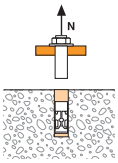


Concrete cone resistance for dry, wet (1) concrete with premium cleaning

$$N_{Rd,c} = N^{O}_{Rd,c} . f_b . \Psi_s . \Psi_{c,N}$$

$N^0_{Rd,p}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design cone resistance						
h_{ef}	*95*	*120*	*144*	*192*	*220*	*280*	*330*
-40°C to +40°C	16,7	26,7	40,0	50,0	63,3	93,3	113,3
-40°C to +80°C	13,3	20,0	26,7	33,3	50,0	76,7	93,3
-40°C to +120°C	10,7	16,7	23,3	33,3	40,0	50,0	63,3

γ_{Mc} = 1,5

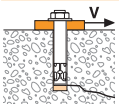


Steel resistance

$N_{Rd,s}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design steel tensile resistance						
SPIT MAXIMA rod	12,9	20,5	29,8	55,6	79,2	114,1	182,6
Std. rod grade 5.8*	12,0	19,3	28,0	52,0	81,3	118,0	186,7
Std. rod grade 8.8*	19,3	30,7	44,7	84,0	130,7	188,0	299,3
Std. rod grade 10.9*	26,4	41,4	60,0	112,1	175,0	252,1	400,7

MAXIMA rod : γ_{Ms} = 1,71 for M8 to M16 and γ_{Ms} = 1,49 for M20 to M30
Std. rod grade 5.8 and 8.8 : γ_{Ms} = 1,5
Std. rod grade 10.9 : γ_{Ms} = 1,4

SHEAR in kN

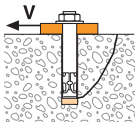


Concrete edge resistance

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

$V^0_{Rd,c}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design concrete edge resistance at minimum edge distance (C_{min})						
h_{ef}	*95*	*120*	*144*	*192*	*220*	*280*	*330*
C_{min}	40	45	55	65	85	105	140
S_{min}	40	45	55	65	85	105	140
$V^0_{Rd,c}$	2,6	3,5	5,1	7,5	12,7	18,9	32,2

γ_{Mc} = 1,5

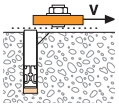


Pryout failure

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

$V^0_{Rd,cp}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design pryout resistance						
h_{ef}	*80*	*90*	*110*	*125*	*170*	*210*	*280*
-40°C to +40°C	33,3	53,3	80,0	100,0	126,7	186,7	226,7
-40°C to +80°C	26,7	40,0	53,3	66,7	100,0	153,3	186,7
-40°C to +120°C	21,3	33,3	46,7	66,7	80,0	100,0	126,7

γ_{Mcp} = 1,5



Steel resistance

$V_{Rd,s}$ Anchor size	M8	M10	M12	M16	M20	M24	M30
	Design steel shear resistance						
SPIT MAXIMA rod	7,7	12,2	17,7	32,9	39,3	56,7	90,7
Std. rod grade 5.8*	7,36	11,6	16,9	31,2	48,8	70,4	112,0
Std. rod grade 8.8*	11,68	18,6	27,0	50,4	78,4	112,8	179,2
Std. rod grade 10.9*	12,2	19,3	28,1	52,0	81,3	117,3	186,7

MAXIMA rod : γ_{Ms} = 1,43 for M8 to M16 and γ_{Ms} = 1,5 for M20 to M30
Std. rod grade 5.8 and 8.8 : γ_{Ms} = 1,25
Std. rod grade 10.9 : γ_{Ms} = 1,5

* 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.

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

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

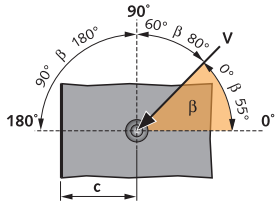
$$\beta_N + \beta_V \leq 1.2$$

f_B Influence of Concrete

Concrete class	f_B
C25/30	1.1
C30/40	1.14
C40/60	1.26
C50/60	1.34

$f_{\beta,V}$ 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

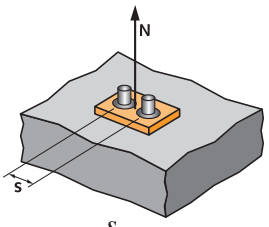







SPIT CC - Method (values issued from ETA)

Ψ_s Influence of spacing for concrete cone resistance in tensile load



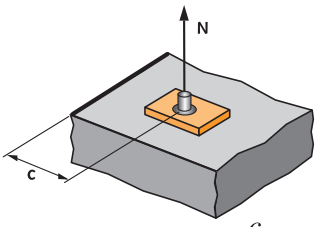
$$\Psi_S = 0{,}5 + \frac{s}{4.h_{ef}}$$

$S_{min} < S < S_{cr,N}$
$S_{cr,N} = 2.h_{ef}$
Ψ_S must be used for each spacing influenced the anchors group.

SPACING S	Reduction factor Ψ_s Non-cracked concrete			
	M8	M10	M12	M16
40	0,61			
45	0,62	0,59		
55	0,64	0,61	0,60	0,57
65	0,67	0,64	0,61	0,58
85	0,72	0,68	0,65	0,61
105	0,78	0,72	0,68	0,64
140	0,87	0,79	0,74	0,68
160	0,92	0,83	0,78	0,71
192	1,00	0,90	0,83	0,75
240		1,00	0,92	0,81
290			1,00	0,88
340				0,94
385				1,00

SPACING S	Reduction factor Ψ_s Non-cracked concrete		
	M20	M24	M30
85	0,60		
105	0,62	0,59	
140	0,66	0,63	0,61
160	0,68	0,64	0,62
180	0,70	0,66	0,64
220	0,75	0,70	0,67
250	0,78	0,72	0,69
300	0,84	0,77	0,73
380	0,93	0,84	0,79
480	1,00	0,93	0,86
580		1,00	0,94
650			0,99
720			1,00

$\Psi_{c,N}$ Influence of edge for concrete cone resistance in tensile load



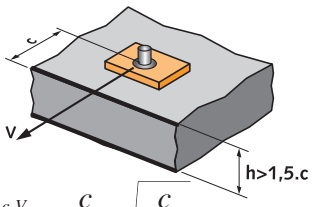
$$\Psi_{c,N} = 0{,}27 + 0{,}725 . \frac{c}{h_{ef}}$$

$C_{min} < C < C_{cr,N}$
$C_{cr,N} = h_{ef}$
$\Psi_{c,N}$ must be used for each distance influenced the anchors group.

EDGE C	Reduction factor $\Psi_{c,N}$ Non-cracked concrete			
	M8	M10	M12	M16
40	0,58			
45	0,61	0,54		
55	0,69	0,60	0,55	
65	0,77	0,66	0,60	0,52
85	0,92	0,78	0,70	0,59
96	1,00	0,85	0,75	0,63
120		1,00	0,87	0,72
145			1,00	0,82
195				1,00

EDGE C	Reduction factor $\Psi_{c,N}$ Non-cracked concrete		
	M20	M24	M30
85	0,55		
105	0,62	0,54	
120	0,67	0,58	
140	0,73	0,63	0,58
170	0,83	0,71	0,64
210	0,96	0,81	0,73
240	1,00	0,89	0,80
290		1,00	0,91
360			1,00

$\Psi_{s-c,V}$ Influence of spacing and edge distance for concrete edge resistance in shear load

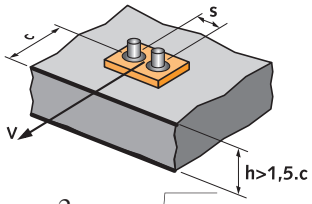


$$\Psi_{s-c,V} = \frac{c}{c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

For single anchor fastening

Factor $\Psi_{s-c,V}$ 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

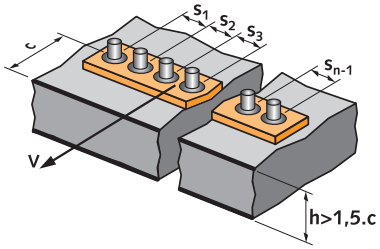


$$\Psi_{s-c,V} = \frac{3.c + s}{6.c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

For 2 anchors

Factor $\Psi_{s-c,V}$ 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 or more

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