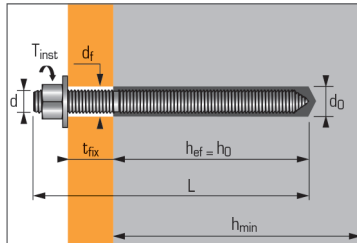


Epoxy resin - High performance for use in cracked and non-cracked concrete



### APPLICATION

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

### MATERIAL

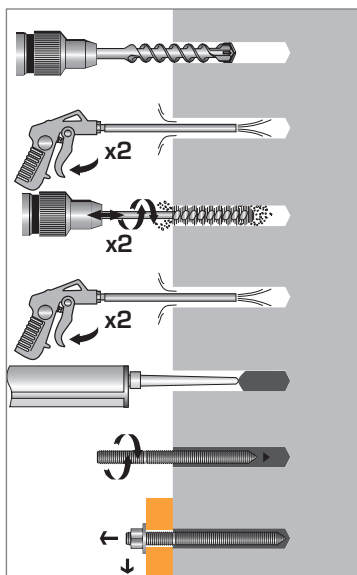
#### Zinc coated steel version :

- Stud M8-M16 :** Steel cold form steel NF A35-053
- Stud M20-M30 :** 11 SMnPb37 - NFA 35-561
- 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 :** 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)	Max. thick. of part to be fixed (mm)	Min. thick. of base material (mm)	Thread diameter (mm)	Drilling depth (mm)	Drilling diameter (mm)	Clearance diameter (mm)	Total anchor length (mm)	Tighten torque (Nm)	Code* MAXIMA stud	
	<b>h<sub>ef</sub></b>	<b>t<sub>fix</sub></b>	<b>h<sub>min</sub></b>	<b>d</b>	<b>h<sub>0</sub></b>	<b>d<sub>0</sub></b>	<b>d<sub>f</sub></b>	<b>L</b>	<b>T<sub>inst</sub></b>	zinc coated st.	stainless steel A4
M8X110	80	15	110	8	80	10	9	110	10	050950	052400
M10X130	90	20	120	10	90	12	12	130	20	050960	052410
M12X160	110	25	140	12	110	14	14	160	30	050970	052420
M16X190	125	35	160	16	125	18	18	190	60	050980	052440
M20X260	170	65	220	20	170	25	22	260	120	655220	052450
M24X300	210	63	265	24	210	28	26	300	200	655240	052470
M30X380	280	70	350	30	280	35	33	380	400	050940	-

EPCON C8 Epoxy resin, dual component cartridge 450 ml

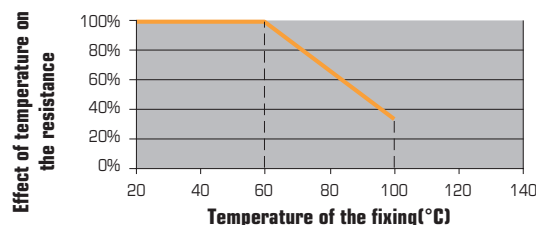
\* These are Maxima studs, for standard studs (zinc coated or stainless steel versions) see catalogue.

### Anchor mechanical properties

Anchor size	M8	M10	M12	M16	M20	M24	M30
<b>MAXIMA stud - zinc coated steel version</b>							
<b>f<sub>uk</sub></b> (N/mm <sup>2</sup> )	Min. tensile strength			600	600	600	600
<b>f<sub>yk</sub></b> (N/mm <sup>2</sup> )	Yield strength			420	420	420	420
<b>M<sup>0</sup><sub>rk,s</sub></b> (Nm)	Characteristic bending moment			22	45	79	200
<b>M</b> (Nm)	Recommended bending moment			11,0	22,5	39,5	100
<b>MAXIMA stud - stainless steel A4 version</b>							
<b>f<sub>uk</sub></b> (N/mm <sup>2</sup> )	Min. tensile strength			700	700	700	700
<b>f<sub>yk</sub></b> (N/mm <sup>2</sup> )	Yield strength			350	350	350	350
<b>M<sup>0</sup><sub>rk,s</sub></b> (Nm)	Characteristic bending moment			26	52	92	233
<b>M</b> (Nm)	Recommended bending moment			12	23	42	122
<b>A<sub>s</sub></b> (mm <sup>2</sup> )	Stressed cross-section			36,6	58	84,3	157
<b>W<sub>el</sub></b> (mm <sup>3</sup> )	Elastic section modulus			31,2	62,3	109,2	277,5

### Setting time

Ambient temperature	Max. time for installation (min)	Waiting time for 45 % load (h)	Curing time (h)
40°C	5	3	6
30°C	8	5	8
20°C	14	6	12
10°C	20	12	23
5°C	26	15	26



### Chemical resistance of the SPIT EPCON C8 resin

Chemical substances	Concentration (%)	Resistance	Chemical substances	Concentration (%)	Resistance
Sulfuric acid	10	(o)	Toluene		(o)
Hydrochloric acid	10	(o)	Ethanol		(o)
Nitric acid	10	(o)	Methyl-ethyl-ketone (MEK)		(-)
Acetic acid	10	(o)	Methanol		(-)
Ammonium hydroxide	10	(o)	DeminerIALIZED water		(+)
Sodium Hypochlorite	5	(o)	Sea water	100	(+)
Sodium hydroxide	50	(o)	Engine Petrol	100	(+)
Acetone		(-)	Motor oil	100	(+)

**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
<b>Number of sealings per cartridge</b>							
EPCON C8 450 ml	119	74	44	24	9	6	3

## 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
<b>Non-cracked concrete</b>							
$h_{ef}$	<b>80</b>	<b>90</b>	<b>110</b>	<b>125</b>	<b>170</b>	<b>210</b>	<b>280</b>
$N_{Ru,m}$	39,4	55,5	81,2	115,0	183,5	257,7	403,8
$N_{Rk}$	32,1	45,2	66,2	93,8	149,8	211,4	330,5
<b>Cracked concrete</b>							
$h_{ef}$	<b>80</b>	<b>90</b>	<b>110</b>	<b>125</b>	<b>170</b>	<b>210</b>	<b>280</b>
$N_{Ru,m}$	27,0	37,7	55,1	82,5	139,4	205,4	340,4
$N_{Rk}$	20,8	29,1	42,3	63,6	107,3	157,9	261,3

### SHEAR

Anchor size	M8	M10	M12	M16	M20	M24	M30
$V_{Ru,m}$	15,9	22,75	32,8	56,2	73,6	115,0	177,7
$V_{Rk}$	11,0	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

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

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

### TENSILE

Anchor size	M8	M10	M12	M16	M20	M24	M30
<b>Non-cracked concrete</b>							
$h_{ef}$	<b>80</b>	<b>90</b>	<b>110</b>	<b>125</b>	<b>170</b>	<b>210</b>	<b>280</b>
$N_{Rd}$	17,8	25,1	36,8	52,1	83,2	117,4	183,6
<b>Cracked concrete</b>							
$h_{ef}$	<b>80</b>	<b>90</b>	<b>110</b>	<b>125</b>	<b>170</b>	<b>210</b>	<b>280</b>
$N_{Rd}$	11,6	16,1	23,5	35,3	59,6	87,7	145,1

$\gamma_{Mc} = 1,8$

### 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

$\gamma_{Ms} = 1,43$  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

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

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

### TENSILE

Anchor size	M8	M10	M12	M16	M20	M24	M30
<b>Non-cracked concrete</b>							
$h_{ef}$	<b>80</b>	<b>90</b>	<b>110</b>	<b>125</b>	<b>170</b>	<b>210</b>	<b>280</b>
$N_{rec}$	12,7	17,9	26,3	37,2	59,4	83,8	131,1
<b>Cracked concrete</b>							
$h_{ef}$	<b>80</b>	<b>90</b>	<b>110</b>	<b>125</b>	<b>170</b>	<b>210</b>	<b>280</b>
$N_{rec}$	8,3	11,5	16,7	25,2	42,5	62,6	103,6

$\gamma_{Mc} = 1,8$

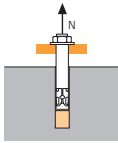
### SHEAR

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

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

### SPIT CC Method (values issued from ETA)

#### TENSILE in kN

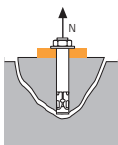


→ Pull-out resistance for dry and wet concrete <sup>(1)</sup>

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

$N_{Rd,p}^0$	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	17,9	25,1	36,9	52,4	83,1	114,4	190,6
Cracked concrete	10,6	14,9	20,7	29,7	50,4	74,8	102,6

$\gamma_{Mc} = 1,8$

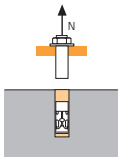


→ Concrete cone resistance for dry and wet concrete <sup>(1)</sup>

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

$N_{Rd,c}^0$	Design cone resistance						
Anchor size	M8	M10	M12	M16	M20	M24	M30
$h_{ef}$	80	90	110	125	170	210	280
Non-cracked concrete	20,0	23,9	32,3	39,1	62,1	85,2	131,2
Cracked concrete	14,3	17,1	23,1	28,0	44,3	60,9	93,7

$\gamma_{Mc} = 1,8$



→ Steel resistance

$N_{Rd,s}$	Steel design tensile resistance						
Anchor size	M8	M10	M12	M16	M20	M24	M30
MAXIMA stud Zn.	12,9	20,5	29,8	55,6	79,2	114,1	182,6
MAXIMA stud A4	12,3	19,8	28,9	54,5	85,0	122,5	-
Std. stud grade 5.8*	12,0	19,3	28,0	52,0	81,3	118,0	186,7
Std. stud grade 8.8*	19,3	30,7	44,7	84,0	130,7	188,0	299,3
Std. stud grade 10.9*	26,4	41,4	60,0	112,1	175,0	252,1	400,7

MAXIMA stud Zn. :  $\gamma_{Ms} = 1,71$  for M8 to M16 and  $\gamma_{Ms} = 2,49$  for M20 to M30

MAXIMA stud A4 :  $\gamma_{Ms} = 1,87$

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

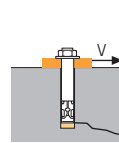
\* Special grade available on request.

<sup>(1)</sup> 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.

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

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

#### SHEAR in kN

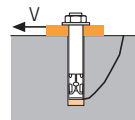


→ Concrete edge resistance

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

$V_{Rd,c}^0$	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	50	60	80	100	120	150
$S_{min}$	40	50	60	80	100	120	150
Non-cracked concrete	2,5	3,8	5,5	9,4	15,4	21,9	34,6
Cracked concrete	1,8	2,7	3,9	6,7	11	15,6	24,7

$\gamma_{Mc} = 1,5$

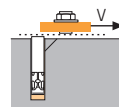


→ Pryout failure

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

$V_{Rd,cp}^0$	Design pryout resistance						
Anchor size	M8	M10	M12	M16	M20	M24	M30
$h_{ef}$	80	90	110	125	170	210	280
Non-cracked concrete	35,7	47,8	64,6	78,3	124,1	170,4	262,4
Cracked concrete	21,2	29,8	41,5	55,9	88,7	121,7	187,4

$\gamma_{Mcp} = 1,5$



→ Steel resistance

$V_{Rd,s}$	Steel design shear resistance						
Anchor size	M8	M10	M12	M16	M20	M24	M30
MAXIMA stud Zn.	7,7	12,2	17,7	32,9	39,3	56,7	90,7
MAXIMA stud A4	7,3	11,9	17,3	32,7	51,3	73,1	-
Std. stud grade 5.8*	7,4	11,6	16,9	31,2	48,8	70,4	112,0
Std. stud grade 8.8*	11,7	18,6	27,0	50,4	78,4	112,8	179,2
Std. stud grade 10.9*	12,2	19,3	28,1	52,0	81,3	117,3	186,7

MAXIMA stud Zn. :  $\gamma_{Ms} = 1,43$  for M8 to M16 and  $\gamma_{Ms} = 1,5$  for M20 to M30

MAXIMA stud A4 :  $\gamma_{Ms} = 1,56$

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

\* Special grade available on request.

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

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

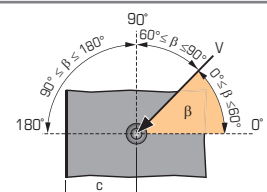
$$\beta_N + \beta_V \leq 1,2$$

#### $f_b$ INFLUENCE OF CONCRETE

Concrete class	$f_b$
C25/30	1,02
C30/40	1,08
C40/60	1,10
C50/60	1,12

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

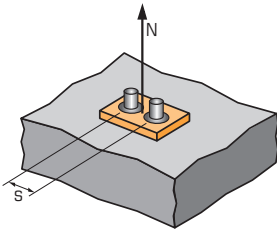
Angle $\beta$ [°]	$f_{\beta,V}$
0 to 55	1
60	1,1
70	1,2
80	1,5
90 to 180	2





## SPIT CC Method (values issued from ETA)

### $\Psi_S$ INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



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

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

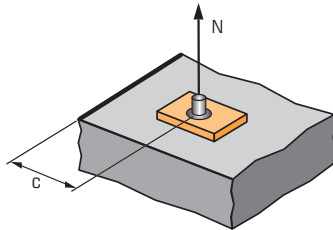
$S_{cr,N} = 3 \cdot h_{ef}$

$\Psi_S$  must be used for each spacing influenced the anchors group.

SPACING S	Reduction factor $\Psi_S$ 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	0,58
80	0,67	0,65	0,62	0,61
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
250	1,00	0,96	0,88	0,83
300		1,00	0,95	0,90
330			1,00	0,94
375				1,00

SPACING S	Reduction factor $\Psi_S$ Cracked & non-cracked concrete		
	Anchor size M20	M24	M30
100	0,60		
120	0,62	0,60	
150	0,65	0,62	0,59
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			1,00
840			1,00

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



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

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

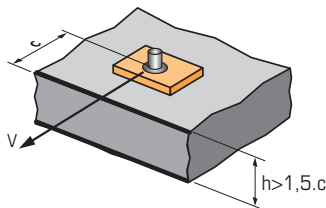
$C_{cr,N} = 1,5 \cdot h_{ef}$

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

EDGE C	Reduction factor $\Psi_{c,N}$ Cracked & non-cracked concrete			
	Anchor size M8	M10	M12	M16
40	0,50			
50	0,56	0,53		
60	0,63	0,58	0,52	
80	0,75	0,69	0,61	0,57
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
100	0,54		
120	0,60	0,54	
150	0,69	0,61	0,52
180	0,78	0,68	0,57
200	0,84	0,73	0,61
255	1,00	0,86	0,71
315		1,00	0,81
420			1,00

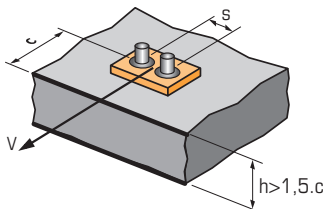
### $\Psi_{s-c,V}$ INFLUENCE OF SPACING AND EDGE DISTANCE FOR CONCRETE EDGE RESISTANCE IN SHEAR LOAD



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

For single anchor fastening

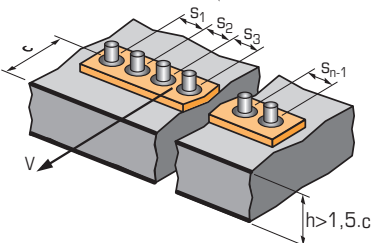
$\frac{C}{C_{min}}$	Reduction factor $\Psi_{s-c,V}$ Cracked & non-cracked concrete												
	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2	
$\Psi_{s-c,V}$	1,00	1,31	1,66	2,02	2,41	2,83	3,26	3,72	4,19	4,69	5,20	5,72	



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

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	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	1,0	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	1,0	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	1,0	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	1,0	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	1,0		1,30	1,52	1,75	1,99	2,24	2,50	2,76	3,04	3,32	3,61	3,91	
4,0	1,0			1,62	1,86	2,10	2,36	2,62	2,89	3,17	3,46	3,75	4,05	
4,5	1,0				1,96	2,21	2,47	2,74	3,02	3,31	3,60	3,90	4,20	
5,0	1,0					2,33	2,59	2,87	3,15	3,44	3,74	4,04	4,35	
5,5	1,0						2,71	2,99	3,28	3,71	4,02	4,33	4,65	
6,0	1,0							2,83	3,11	3,41	3,71	4,02	4,33	4,65

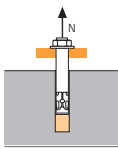


For 3 anchors fastening and more

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

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

#### TENSILE in kN

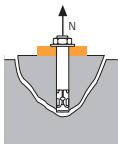


##### → Pull-out resistance

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

$N_{Rd,p,C1}^0$	Design pull-out resistance		
Anchor size	M10	M12	M16
<b>Category C1 - Single anchor</b>			
$h_{ef}$	90	110	125
$N_{Rd,p,C1}^0$ (C20/25)	9,7	13,1	23,7
<b>Category C1 - Group of anchors <sup>(1)</sup></b>			
$h_{ef}$	90	110	125
$N_{Rd,p,C1}^0$ (C20/25)	8,2	11,1	20,2

<sup>(1)</sup> when more than one anchor of the group is submitted to tensile load  
 $\gamma_{Mc} = 1,8$

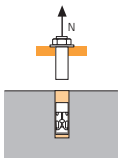


##### → Concrete cone resistance

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

$N_{Rd,c,C1}^0$	Design cone resistance		
Anchor size	M10	M12	M16
<b>Category C1 - Single anchor</b>			
$h_{ef}$	90	110	125
$N_{Rd,c,C1}^0$ (C20/25)	9,4	12,4	19,0
<b>Category C1 - Group of anchors <sup>(1)</sup></b>			
$h_{ef}$	90	110	125
$N_{Rd,c,C1}^0$ (C20/25)	8,3	10,9	16,8

<sup>(1)</sup> when more than one anchor of the group is submitted to tensile load  
 $\gamma_{Mc} = 1,8$



##### → Steel resistance

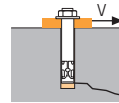
$N_{Rd,s,C1}$	Steel design tensile resistance		
Anchor size	M10	M12	M16
MAXIMA stud Zn.	20,5	29,8	55,6
MAXIMA stud A4	21,9	31,6	58,8
Std. stud grade 5.8	19,3	28,0	52,0
Std. stud grade 8.8	30,7	44,7	84,0

<sup>(1)</sup> when more than one anchor of the group is submitted to tensile load  
 MAXIMA stud Zn. :  $\gamma_{Ms} = 1,8$  and MAXIMA stud A4 :  $\gamma_{Ms} = 1,87$   
 Std. stud grade 5.8 and 8.8 :  $\gamma_{Ms} = 1,5$

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

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

#### SHEAR in kN

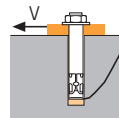


##### → Concrete edge resistance

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

$V_{Rd,c,C1}^0$	Design concrete edge resistance at minimum edge distance ( $C_{min}$ )		
Anchor size	M10	M12	M16
<b>Category C1 - Single anchor</b>			
$h_{ef}$	90	110	125
$C_{min}$	50	60	80
$S_{min}$	45	55	65
$V_{Rd,c,C1}^0$ (C20/25)	3,8	5,5	9,4
<b>Category C1 - Group of anchors <sup>(1)</sup></b>			
$h_{ef}$	90	110	125
$C_{min}$	50	60	80
$S_{min}$	45	55	65
$V_{Rd,c,C1}^0$ (C20/25)	3,3	4,7	8,0

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

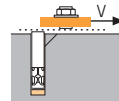


##### → Pryout failure

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

$V_{Rd,cp,C1}^0$	Design pryout resistance		
Anchor size	M10	M12	M16
<b>Category C1 - Single anchor</b>			
$h_{ef}$	90	110	125
$V_{Rd,cp,C1}^0$ (C20/25)	22,6	29,7	45,6
<b>Category C1 - Group of anchors <sup>(1)</sup></b>			
$h_{ef}$	90	110	125
$V_{Rd,cp,C1}^0$ (C20/25)	20,0	26,2	40,2

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



##### → Steel resistance <sup>(2)</sup>

$V_{Rd,s,C1}$	Steel design shear resistance		
Anchor size	M10	M12	M16
<b>Category C1 - Single anchor</b>			
MAXIMA stud Zn.	8,5	12,4	23,0
MAXIMA stud A4	12,8	19,2	35,3
Std. stud grade 5.8	8,1	11,8	21,8
Std. stud grade 8.8	18,6	27,0	50,4
<b>Category C1 - Group of anchors <sup>(1)</sup></b>			
MAXIMA stud Zn.	7,2	10,5	19,6
MAXIMA stud A4	10,9	16,3	30,0
Std. stud grade 5.8	6,9	10,0	18,6
Std. stud grade 8.8	15,8	22,9	42,8

<sup>(1)</sup> when more than one anchor of the group is submitted to shear load  
<sup>(2)</sup> In case of no hole clearance between anchor and fixture.  
 MAXIMA stud Zn. :  $\gamma_{Ms} = 1,43$  and MAXIMA stud A4 :  $\gamma_{Ms} = 1,56$   
 Std. stud grade 5.8 and 8.8 :  $\gamma_{Ms} = 1,25$

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

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

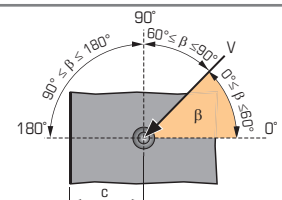
$$\beta_N + \beta_V \leq 1,2$$

#### $f_b$ INFLUENCE OF CONCRETE

Concrete class	$f_b$
C25/30	1,02
C30/40	1,08
C40/60	1,10
C50/60	1,12

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

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





**I-EXPERT by SPIT**

FILE DATA CALCULATE OPTIONS TECHNICAL HELP

1. APPLICATIONS 2. DIMENSIONS 3. MATERIAL 4. LOADS 5. METHOD 6. CALCULATE

Static Loads and Static Loads Combinations

Seismic Loads

Seismicity level acc. to National Annex of En 1988-1  
ag.S ≤ 0,05.g

Building importance classes  
Class II

Type of connections  
 Structural Elements  Non-Structural Elements  
 Seismic Performance not required  
 Seismic Performance Category C1  
 Seismic Performance Category C2

Design option  
 q=1  q=1.2

Limiting displacement  
 Displacement values for the Damage Limitation State acc. to the ETA  
 Displacement values for the Damage Limitation State required for your application

Accidental combination under seismic loads  
 Nz: 0.00 kN Mx: 0.00 kNm  
 Vx: 0.00 kN My: 0.00 kNm  
 Vy: 0.00 kN Mz: 0.00 kNm

3D diagram: Nz: 10.00 kN, Vx: 5.00 kN, Mx: 2.00 kNm

2D diagram: Lx = 250, Ly = 250, Thickness = 8, S2 = 120, C2y = -, C1x = -, S1 = 120, C2x = -

Length: mm Load: kN Moment: kNm

**SPIT CALCULATION SHEET FOR SPIT ANCHOR FIXING**

Company name: Carried out by:  
Phone number: Mail contact:

Project:  
Company name: Project name:  
Contact name: Location:  
Phone number: Fastening point:  
Mail contact: Comment:

Concrete member:  
Concrete resistance: C25/30  
Thickness of the base material: 230 mm  
Reinforcement type: Wide concrete reinforcement

Cracking of concrete: Cracked concrete  
Edge reinforcement: Straight edge reinforcement

Conditions:  
Installation conditions: Dry hole  
Short term temperature: 40 °C  
Long term temperature: 24 °C

Calculation hypothesis:  
- The anchoring plate is assumed to be sufficient to resist deformation imposed by the load actions!  
- Connection between profile and base plate has not checked

Part to be fixed:  
Thickness of part to be fixed: 8 mm  
Clearance diameter: 18 mm  
The base plate thickness has not been checked

Recommended anchors: EPCON C8 XTREM THREADED MAXIMA STUD / M16 / hef = 125 mm

Calculation model:  
Profile family: RHSS0x5  
Profile position: Ex: 0, Ey: 0  
Stand-off not defined

Geometry:  
Nz: 10.00 kN  
Vx: 5.00 kN  
My: 0.00 kNm  
Mx: 2.00 kNm

Design Actions: Seismic Loads  
 Nz: 10 kN Mx: 2 kNm  
 Vx: 5 kN My: 0 kNm  
 Vy: 0 kN Mz: 0 kNm  
 Seismic performance: Seismic Performance Category C1  
 Seismicity level: ag.S ≤ 0.05.g  
 Building importance class: II  
 Type of connections: Structural Elements  
 No filled holes

Splitting failure:  
 $k_1 = 7.2; S_{cr} = 322 \text{ mm}; C_{edge} = 161 \text{ mm}$   
 $N_{Rk,split} = 55.11 \text{ kN}; A_{cr}/A_{ch} = 1.88$   
 $E_{ch} = 41 \text{ mm}; E_{ch} = 0 \text{ mm}$   
 $\psi_{ch,cr} = 0.797; \psi_{ch,cr} = 1.000$   
 $\psi_{ch} = 1.000; \psi_{ch} = 1.000; \psi_{ch} = 1.266; \alpha_{ch} = 0.85$   
 $N_{Rk,split} = 89.2 \text{ kN}; N_{Rk,split} = 49.56 \text{ kN}; \gamma_{M2,split} = 1.8$   
 $N_{Ed} = 20.33 \text{ kN}; \beta_{Ed} = 0.41$

Steel failure:  
 $N_{Rk,steel} = 94 \text{ kN}; \alpha_{ch} = 0.85$   
 $N_{Rk,steel} = 94 \text{ kN}; N_{Rk,steel} = 54.97 \text{ kN}; \gamma_{M2,steel} = 1.71$   
 $N_{Ed} = 8.58 \text{ kN}; \beta_{Ed} = 0.16$

On the group of anchors:

Loads on anchors group:  
 Shear [y]  
 $N_{Ed} = 8.58 \text{ kN}$   
 $V_{Ed} = 1.25 \text{ kN}$   
 $V_{Ed} = 5 \text{ kN}$   
 $N_{Ed} = 20.33 \text{ kN}$   
 $V_{Ed} = 5 \text{ kN}$   
 $V_{Ed} = 0 \text{ kN}$

Concrete edge failure:  
 Failure mode not decisive  
 Pryout failure:  
 $k_1 = 7.2; S_{cr} = 375 \text{ mm}; C_{edge} = 188 \text{ mm}$   
 $N_{Rk,pry} = 55.11 \text{ kN}; A_{cr}/A_{ch} = 1.75$   
 $E_{ch} = 41 \text{ mm}; E_{ch} = 0 \text{ mm}$   
 $\psi_{ch,cr} = 0.821; \psi_{ch,cr} = 1.000$   
 $\psi_{ch} = 1.000; \psi_{ch} = 1.000$   
 $\psi_{ch} = 0.75; \alpha_{ch} = 0.5$   
 $V_{Rk,pry} = 192.84 \text{ kN};$   
 $V_{Rk,pry} = 128.56 \text{ kN}; \gamma_{M2,pry} = 1.8$   
 $N_{Rk,pry} = 96.42 \text{ kN}$   
 k-factor = 2  
 $V_{Rk,pry} = 192.84 \text{ kN}; F_{pry} = 0$   
 $V_{Rk,pry} = 128.56 \text{ kN}; \gamma_{M2,pry} = 0$   
 $V_{Ed,pry} = 5 \text{ kN}; \beta_{Ed,pry} = 0.04$

Steel failure:  
 Without level arm  
 $V_{Rk,steel} = 13.98 \text{ kN}$   
 $\alpha_{ch} = 0.85; \alpha_{ch} = 0.5$   
 $V_{Rk,steel} = 13.98 \text{ kN}$   
 $V_{Rk,steel} = 9.78 \text{ kN}; \gamma_{M2,steel} = 1.43$   
 $V_{Ed,steel} = 1.25 \text{ kN}; \beta_{Ed,steel} = 0.13$

the base plate

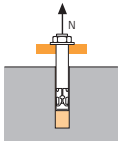
MAXIMA STUD / M16 / hef = 125 mm  
09/01/2015 / Validity: 01/01/0001

25 mm
81 mm
8 mm
25 mm
10.00 Nm
2325
1 mm
RHS50x5
8 mm

Chemical anchors

### SPIT CC Method (values issued from ETA)

#### TENSILE in kN

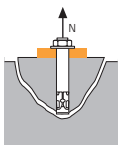


→ **Pull-out resistance for dry and wet concrete <sup>(1)</sup>**

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
<b><math>N_{Rd,p}^0</math></b>	<b>95</b>	<b>120</b>	<b>144</b>	<b>192</b>	<b>220</b>	<b>280</b>	<b>330</b>
<b>Design pull-out resistance</b>							
<b>Anchor size</b>	<b>M8</b>	<b>M10</b>	<b>M12</b>	<b>M16</b>	<b>M20</b>	<b>M24</b>	<b>M30</b>
<b><math>h_{ef}</math></b>	<b>95</b>	<b>120</b>	<b>144</b>	<b>192</b>	<b>220</b>	<b>280</b>	<b>330</b>
<b>Non-cracked concrete</b>	21,2	33,5	48,3	80,4	107,5	152,5	224,6
<b>Cracked concrete</b>	12,6	19,9	27,1	45,6	65,3	99,7	121,0

$\gamma_{Mc} = 1,8$

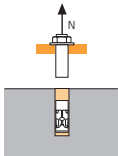


→ **Concrete cone resistance for dry and wet concrete <sup>(1)</sup>**

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
<b><math>N_{Rd,c}^0</math></b>	<b>95</b>	<b>120</b>	<b>144</b>	<b>192</b>	<b>220</b>	<b>280</b>	<b>330</b>
<b>Design cone resistance</b>							
<b>Anchor size</b>	<b>M8</b>	<b>M10</b>	<b>M12</b>	<b>M16</b>	<b>M20</b>	<b>M24</b>	<b>M30</b>
<b><math>h_{ef}</math></b>	<b>95</b>	<b>120</b>	<b>144</b>	<b>192</b>	<b>220</b>	<b>280</b>	<b>330</b>
<b>Non-cracked concrete</b>	25,9	36,8	48,4	74,5	91,4	131,2	167,9
<b>Cracked concrete</b>	18,5	26,3	34,6	53,2	65,3	93,7	119,9

$\gamma_{Mc} = 1,8$



→ **Steel resistance**

Anchor size	M8	M10	M12	M16	M20	M24	M30
<b><math>N_{Rd,s}</math></b>							
<b>Steel design tensile resistance</b>							
<b>Anchor size</b>	<b>M8</b>	<b>M10</b>	<b>M12</b>	<b>M16</b>	<b>M20</b>	<b>M24</b>	<b>M30</b>
<b>MAXIMA stud Zn.</b>	12,9	20,5	29,8	55,6	79,2	114,1	182,6
<b>MAXIMA stud A4</b>	12,3	19,8	28,9	54,5	85,0	122,5	-
<b>Std. stud grade 5.8*</b>	12,0	19,3	28,0	52,0	81,3	118,0	186,7
<b>Std. stud grade 8.8*</b>	19,3	30,7	44,7	84,0	130,7	188,0	299,3
<b>Std. stud grade 10.9*</b>	26,4	41,4	60,0	112,1	175,0	252,1	400,7

MAXIMA stud Zn. :  $\gamma_{Ms} = 1,71$  for M8 to M16 and  $\gamma_{Ms} = 2,49$  for M20 to M30

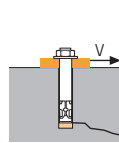
MAXIMA stud A4 :  $\gamma_{Ms} = 1,87$

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

\* Special grade available on request.

<sup>(1)</sup> 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

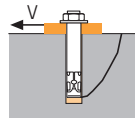


→ **Concrete edge resistance**

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
<b><math>V_{Rd,c}^0</math></b>							
<b>Design concrete edge resistance at minimum edge distance (<math>C_{min}</math>)</b>							
<b>Anchor size</b>	<b>M8</b>	<b>M10</b>	<b>M12</b>	<b>M16</b>	<b>M20</b>	<b>M24</b>	<b>M30</b>
<b><math>h_{ef}</math></b>	<b>95</b>	<b>120</b>	<b>144</b>	<b>192</b>	<b>220</b>	<b>280</b>	<b>330</b>
<b><math>C_{min}</math></b>	40	50	60	80	100	120	150
<b><math>S_{min}</math></b>	40	50	60	80	100	120	150
<b>Non-cracked concrete</b>	2,6	3,5	5,1	7,5	12,7	18,9	32,2
<b>Cracked concrete</b>	1,8	2,5	3,6	5,3	9	13,5	23

$\gamma_{Mc} = 1,5$

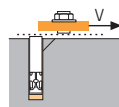


→ **Pryout failure**

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
<b><math>V_{Rd,cp}^0</math></b>							
<b>Design pryout resistance</b>							
<b>Anchor size</b>	<b>M8</b>	<b>M10</b>	<b>M12</b>	<b>M16</b>	<b>M20</b>	<b>M24</b>	<b>M30</b>
<b><math>h_{ef}</math></b>	<b>95</b>	<b>120</b>	<b>144</b>	<b>192</b>	<b>220</b>	<b>280</b>	<b>330</b>
<b>Non-cracked concrete</b>	42,4	67,0	96,5	149,0	182,7	262,4	335,7
<b>Cracked concrete</b>	25,2	39,8	54,3	91,1	130,5	187,4	239,8

$\gamma_{Mcp} = 1,5$



→ **Steel resistance**

Anchor size	M8	M10	M12	M16	M20	M24	M30
<b><math>V_{Rd,s}</math></b>							
<b>Steel design shear resistance</b>							
<b>Anchor size</b>	<b>M8</b>	<b>M10</b>	<b>M12</b>	<b>M16</b>	<b>M20</b>	<b>M24</b>	<b>M30</b>
<b>MAXIMA stud Zn.</b>	7,7	12,2	17,7	32,9	39,3	56,7	90,7
<b>MAXIMA stud A4</b>	7,3	11,9	17,3	32,7	51,3	73,1	-
<b>Std. stud grade 5.8*</b>	7,4	11,6	16,9	31,2	48,8	70,4	112,0
<b>Std. stud grade 8.8*</b>	11,7	18,6	27,0	50,4	78,4	112,8	179,2
<b>Std. stud grade 10.9*</b>	12,2	19,3	28,1	52,0	81,3	117,3	186,7

MAXIMA stud Zn. :  $\gamma_{Ms} = 1,43$  for M8 to M16 and  $\gamma_{Ms} = 1,5$  for M20 to M30

MAXIMA stud A4 :  $\gamma_{Ms} = 1,56$

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

\* Special grade available on request.

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

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

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

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

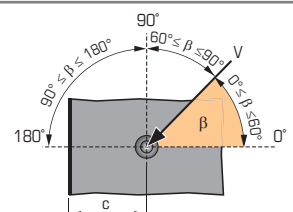
$$\beta_N + \beta_V \leq 1,2$$

#### $f_b$ INFLUENCE OF CONCRETE

Concrete class	$f_b$
C25/30	1,02
C30/40	1,08
C40/60	1,10
C50/60	1,12

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

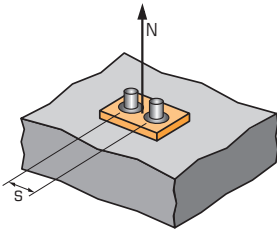
Angle $\beta$ [°]	$f_{\beta,V}$
0 to 55	1
60	1,1
70	1,2
80	1,5
90 to 180	2





## SPIT CC Method (values issued from ETA)

### Ψ<sub>S</sub> INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



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

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

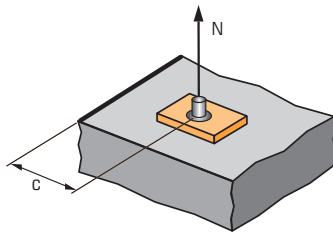
$S_{cr,N} = 3 \cdot h_{ef}$

Ψ<sub>S</sub> must be used for each spacing influenced the anchors group.

SPACING S	Reduction factor Ψ <sub>S</sub> 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	0,55
80	0,64	0,61	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 <sub>S</sub> Cracked & non-cracked concrete		
	Anchor size M20	M24	M30
100	0,58		
120	0,59	0,57	
150	0,61	0,59	0,58
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

### Ψ<sub>c,N</sub> INFLUENCE OF EDGE FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



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

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

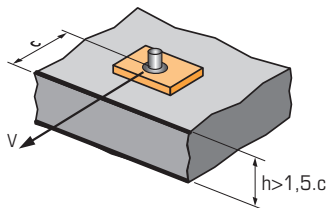
$C_{cr,N} = 1,5 \cdot h_{ef}$

Ψ<sub>c,N</sub> must be used for each distance influenced the anchors group.

EDGE C	Reduction factor Ψ <sub>c,N</sub> Cracked & non-cracked concrete			
	Anchor size M8	M10	M12	M16
40	0,46			
50	0,51	0,46		
60	0,57	0,50	0,46	
80	0,67	0,58	0,53	0,46
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 Ψ <sub>c,N</sub> Cracked & non-cracked concrete		
	Anchor size M20	M24	M30
100	0,48		
120	0,52	0,46	
150	0,59	0,52	0,48
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

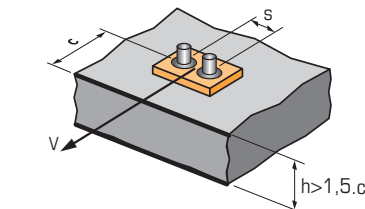
### Ψ<sub>s-c,V</sub> INFLUENCE OF SPACING AND EDGE DISTANCE FOR CONCRETE EDGE RESISTANCE IN SHEAR LOAD



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

For single anchor fastening

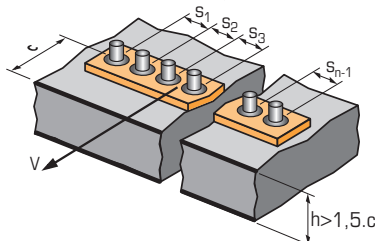
C / C <sub>min</sub>	Reduction factor Ψ <sub>s-c,V</sub> Cracked & non-cracked concrete												
	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2	
Ψ <sub>s-c,V</sub>	1,00	1,31	1,66	2,02	2,41	2,83	3,26	3,72	4,19	4,69	5,20	5,72	



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

For 2 anchors fastening

S / C <sub>min</sub>	Reduction factor Ψ <sub>s-c,V</sub> Cracked & non-cracked concrete												
	C / C <sub>min</sub> 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



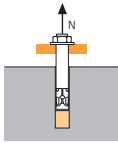
For 3 anchors fastening and more

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



### SPIT CC Method (values issued from ETA)

#### TENSILE in kN

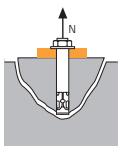


→ **Pull-out resistance for dry and wet concrete <sup>(1)</sup>**

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

Anchor size	Design pull-out resistance						
	M8	M10	M12	M16	M20	M24	M30
<b>h<sub>ef</sub></b>	<b>128</b>	<b>160</b>	<b>192</b>	<b>256</b>	<b>320</b>	<b>384</b>	<b>480</b>
Non-cracked concrete	28,6	44,7	64,3	107,2	156,4	209,1	326,7
Cracked concrete	17,0	26,5	36,2	60,8	94,9	136,7	175,9

$\gamma_{Mc} = 1,8$

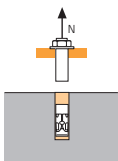


→ **Concrete cone resistance for dry and wet concrete <sup>(1)</sup>**

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

Anchor size	Design cone resistance						
	M8	M10	M12	M16	M20	M24	M30
<b>h<sub>ef</sub></b>	<b>128</b>	<b>160</b>	<b>192</b>	<b>256</b>	<b>320</b>	<b>384</b>	<b>480</b>
Non-cracked concrete	40,5	56,7	74,5	114,7	160,3	210,7	294,5
Cracked concrete	29,0	40,5	53,2	81,9	114,5	150,5	210,3

$\gamma_{Mc} = 1,8$



→ **Steel resistance**

Anchor size	Steel design tensile resistance						
	M8	M10	M12	M16	M20	M24	M30
Std. stud grade 5.8*	12,0	19,3	28,0	52,0	81,3	118,0	186,7
Std. stud grade 8.8*	19,3	30,7	44,7	84,0	130,7	188,0	299,3
Std. stud grade 10.9*	26,4	41,4	60,0	112,1	175,0	252,1	400,7

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

Std. stud grade 10.9 :  $\gamma_{Ms} = 1,4$

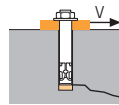
\* Special grade available on request.

<sup>(1)</sup> 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

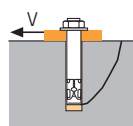


→ **Concrete edge resistance**

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

Anchor size	Design concrete edge resistance at minimum edge distance (C <sub>min</sub> )						
	M8	M10	M12	M16	M20	M24	M30
<b>h<sub>ef</sub></b>	<b>128</b>	<b>160</b>	<b>192</b>	<b>256</b>	<b>320</b>	<b>384</b>	<b>480</b>
<b>C<sub>min</sub></b>	40	50	60	80	100	120	150
<b>S<sub>min</sub></b>	40	50	60	80	100	120	150
Non-cracked concrete	2,8	3,7	5,4	7,9	13,7	20,2	34,7
Cracked concrete	2,0	2,6	3,8	5,6	9,7	14,4	24,7

$\gamma_{Mc} = 1,5$

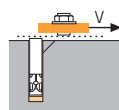


→ **Pryout failure**

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

Anchor size	Design pryout resistance						
	M8	M10	M12	M16	M20	M24	M30
<b>h<sub>ef</sub></b>	<b>128</b>	<b>160</b>	<b>192</b>	<b>256</b>	<b>320</b>	<b>384</b>	<b>480</b>
Non-cracked concrete	57,2	89,4	128,7	214,5	312,8	418,2	588,9
Cracked concrete	34,0	53,1	72,4	121,5	189,9	273,4	351,9

$\gamma_{Mcp} = 1,5$



→ **Steel resistance**

Anchor size	Steel design shear resistance						
	M8	M10	M12	M16	M20	M24	M30
Std. stud grade 5.8*	7,4	11,6	16,9	31,2	48,8	70,4	112,0
Std. stud grade 8.8*	11,7	18,6	27,0	50,4	78,4	112,8	179,2
Std. stud grade 10.9*	12,2	19,3	28,1	52,0	81,3	117,3	186,7

Std. stud grade 5.8 and 8.8 :  $\gamma_{Ms} = 1,25$

Std. stud grade 10.9 :  $\gamma_{Ms} = 1,5$

\* Special grade available on request.

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

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

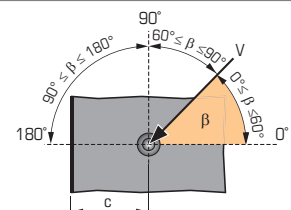
$$\beta_N + \beta_V \leq 1,2$$

#### $f_b$ INFLUENCE OF CONCRETE

Concrete class	$f_b$
C25/30	1,02
C30/40	1,08
C40/60	1,10
C50/60	1,12

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

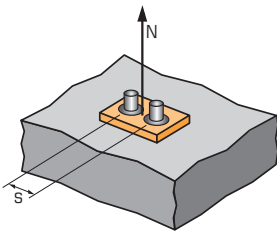
Angle $\beta$ [°]	$f_{\beta,V}$
0 to 55	1
60	1,1
70	1,2
80	1,5
90 to 180	2





## SPIT CC Method (values issued from ETA)

### Ψ<sub>S</sub> INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



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

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

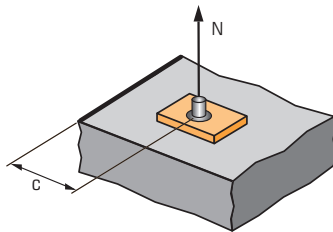
$$S_{cr,N} = 3 \cdot h_{ef}$$

Ψ<sub>S</sub> must be used for each spacing influenced the anchors group.

SPACING S	Reduction factor Ψ <sub>S</sub>			
	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
80	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 <sub>S</sub>		
	Cracked & non-cracked concrete		
Anchor size	M20	M24	M30
100	0,55		
120	0,56	0,55	
150	0,58	0,57	0,55
250	0,63	0,61	0,59
350	0,68	0,65	0,62
550	0,79	0,74	0,69
650	0,84	0,78	0,73
750	0,89	0,83	0,76
850	0,94	0,87	0,80
960	1,00	0,92	0,83
1150		1,00	0,90
1440			1,00

### Ψ<sub>c,N</sub> INFLUENCE OF EDGE FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



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

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

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

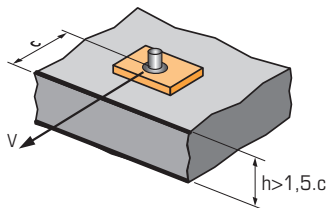
Ψ<sub>c,N</sub> must be used for each distance influenced the anchors group.

EDGE C	Reduction factor Ψ <sub>c,N</sub>			
	Cracked & non-cracked concrete			
Anchor size	M8	M10	M12	M16
40	0,41			
50	0,45	0,41		
60	0,48	0,44	0,41	
80	0,56	0,50	0,46	0,41
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 Ψ <sub>c,N</sub>		
	Cracked & non-cracked concrete		
Anchor size	M20	M24	M30
100	0,41		
120	0,44	0,41	
150	0,48	0,45	0,41
250	0,64	0,58	0,51
300	0,72	0,64	0,56
480	1,00	0,88	0,75
580		1,00	0,85
720			1,00

Chemical anchors

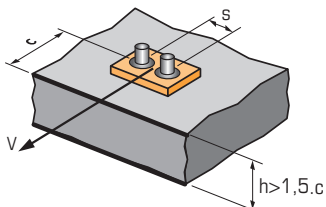
### Ψ<sub>s-c,V</sub> INFLUENCE OF SPACING AND EDGE DISTANCE FOR CONCRETE EDGE RESISTANCE IN SHEAR LOAD



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

#### For single anchor fastening

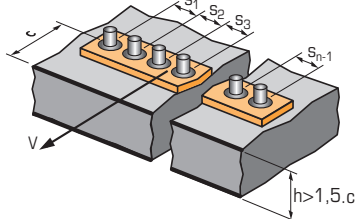
C / C <sub>min</sub>	Reduction factor Ψ <sub>s-c,V</sub>												
	Cracked & non-cracked concrete												
	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2	
Ψ <sub>s-c,V</sub>	1,00	1,31	1,66	2,02	2,41	2,83	3,26	3,72	4,19	4,69	5,20	5,72	



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

#### For 2 anchors fastening

S / C <sub>min</sub>	Reduction factor Ψ <sub>s-c,V</sub>												
	Cracked & non-cracked concrete												
C / C <sub>min</sub>	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

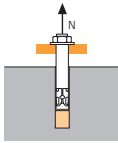


#### For 3 anchors fastening and more

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

### SPIT CC Method (values issued from ETA)

#### TENSILE in kN

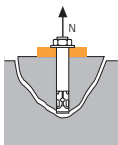


→ **Pull-out resistance for dry and wet concrete <sup>(1)</sup>**

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

$N_{Rd,p}^0$	Design pull-out resistance						
Anchor size	M8	M10	M12	M16	M20	M24	M30
$h_{ef}$	160	200	240	320	400	480	600
Non-cracked concrete	35,7	55,9	80,4	134,0	195,5	261,4	408,4
Cracked concrete	21,2	33,2	45,2	76,0	118,7	170,9	219,9

$\gamma_{Mc} = 1,8$

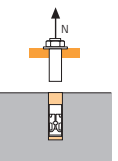


→ **Concrete cone resistance for dry and wet concrete <sup>(1)</sup>**

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

$N_{Rd,c}^0$	Design cone resistance						
Anchor size	M8	M10	M12	M16	M20	M24	M30
$h_{ef}$	160	200	240	320	400	480	600
Non-cracked concrete	56,7	79,2	104,1	160,3	224,0	294,5	411,5
Cracked concrete	40,5	56,6	74,4	114,5	160,0	210,3	293,9

$\gamma_{Mc} = 1,8$



→ **Steel resistance**

$N_{Rd,s}$	Steel design tensile resistance						
Anchor size	M8	M10	M12	M16	M20	M24	M30
Std. stud grade 5.8*	12,0	19,3	28,0	52,0	81,3	118,0	186,7
Std. stud grade 8.8*	19,3	30,7	44,7	84,0	130,7	188,0	299,3
Std. stud grade 10.9*	26,4	41,4	60,0	112,1	175,0	252,1	400,7

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

Std. stud grade 10.9 :  $\gamma_{Ms} = 1,4$

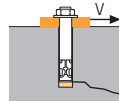
\* Special grade available on request.

<sup>(1)</sup> 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

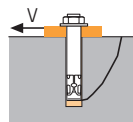


→ **Concrete edge resistance**

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

$V_{Rd,c}^0$	Design concrete edge resistance at minimum edge distance ( $C_{min}$ )						
Anchor size	M8	M10	M12	M16	M20	M24	M30
$h_{ef}$	160	200	240	320	400	480	600
$C_{min}$	40	50	60	80	100	120	150
$S_{min}$	40	50	60	80	100	120	150
Non-cracked concrete	2,9	3,9	5,7	8,3	14,3	21,1	36,3
Cracked concrete	2,0	2,7	4	5,9	10,2	15	25,9

$\gamma_{Mc} = 1,5$

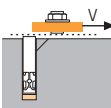


→ **Pryout failure**

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

$V_{Rd,cp}^0$	Design pryout resistance						
Anchor size	M8	M10	M12	M16	M20	M24	M30
$h_{ef}$	160	200	240	320	400	480	600
Non-cracked concrete	71,5	111,7	160,8	268,1	391,0	522,8	816,8
Cracked concrete	42,4	66,3	90,5	151,9	237,4	341,8	439,8

$\gamma_{Mcp} = 1,5$



→ **Steel resistance**

$V_{Rd,s}$	Steel design shear resistance						
Anchor size	M8	M10	M12	M16	M20	M24	M30
Std. stud grade 5.8*	7,4	11,6	16,9	31,2	48,8	70,4	112,0
Std. stud grade 8.8*	11,7	18,6	27,0	50,4	78,4	112,8	179,2
Std. stud grade 10.9*	12,2	19,3	28,1	52,0	81,3	117,3	186,7

Std. stud grade 5.8 and 8.8 :  $\gamma_{Ms} = 1,25$

Std. stud grade 10.9 :  $\gamma_{Ms} = 1,5$

\* Special grade available on request.

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

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

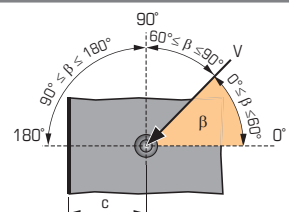
$$\beta_N + \beta_V \leq 1,2$$

#### $f_b$ INFLUENCE OF CONCRETE

Concrete class	$f_b$
C25/30	1,02
C30/40	1,08
C40/60	1,10
C50/60	1,12

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

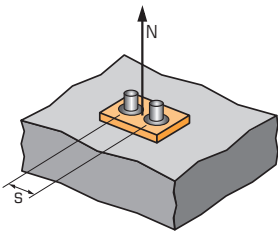
Angle $\beta$ [°]	$f_{\beta,V}$
0 to 55	1
60	1,1
70	1,2
80	1,5
90 to 180	2





## SPIT CC Method (values issued from ETA)

### $\Psi_S$ INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



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

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

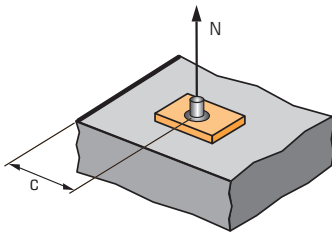
$S_{cr,N} = 3 \cdot h_{ef}$

$\Psi_S$  must be used for each spacing influenced the anchors group.

SPACING S	Reduction factor $\Psi_S$ Cracked & non-cracked concrete			
	Anchor size M8	M10	M12	M16
40	0,54			
50	0,55	0,54		
60	0,56	0,55	0,54	0,53
80	0,58	0,57	0,56	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 $\Psi_S$ Cracked & non-cracked concrete		
	Anchor size M20	M24	M30
100	0,54		
120	0,55	0,54	
150	0,56	0,55	0,54
250	0,60	0,59	0,57
350	0,65	0,62	0,60
450	0,69	0,66	0,63
600	0,75	0,71	0,67
800	0,83	0,78	0,72
1000	0,92	0,85	0,78
1200	1,00	0,92	0,83
1450		1,00	0,90
1800			1,00

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



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

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

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

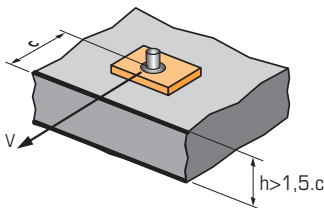
$\Psi_{c,N}$  must be used for each distance influenced the anchors group.

EDGE C	Reduction factor $\Psi_{c,N}$ Cracked & non-cracked concrete			
	Anchor size M8	M10	M12	M16
40	0,38			
50	0,41	0,38		
60	0,44	0,40	0,38	
80	0,50	0,45	0,42	0,38
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	M30
100	0,38		
120	0,40	0,38	
150	0,44	0,41	0,38
250	0,56	0,51	0,46
400	0,75	0,67	0,58
600	1,00	0,88	0,75
720		1,00	0,85
900			1,00

Chemical anchors

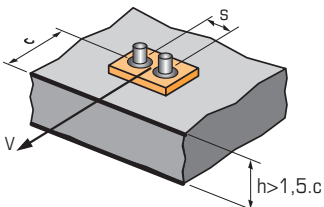
### $\Psi_{s-c,V}$ INFLUENCE OF SPACING AND EDGE DISTANCE FOR CONCRETE EDGE RESISTANCE IN SHEAR LOAD



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

For single anchor fastening

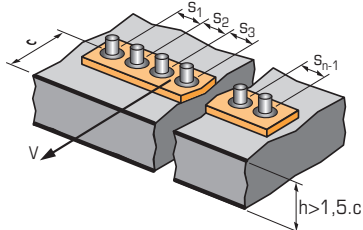
$\frac{C}{C_{min}}$	Reduction factor $\Psi_{s-c,V}$ Cracked & non-cracked concrete												
	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2	
$\Psi_{s-c,V}$	1,00	1,31	1,66	2,02	2,41	2,83	3,26	3,72	4,19	4,69	5,20	5,72	



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

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	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	1,0	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	1,0	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	1,0	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	1,0	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

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