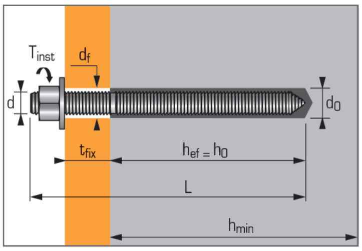
EPCON C8 XTREM

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

ETA European Technical Assessment
ETA Option 1 - 10/0309

XTREM

INOX STAINLESS STEEL



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 :

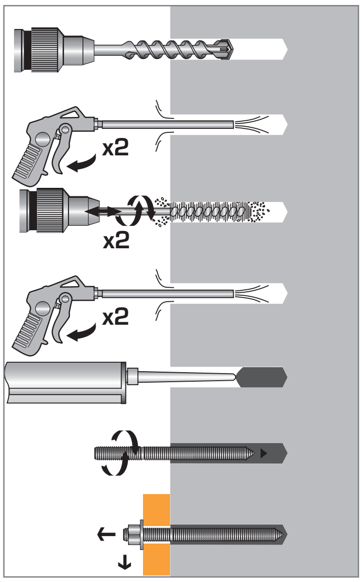
- **Stud :** A4-70 as per ISO 3506-1
- **Nut :** Stainless steel A4-80,

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) 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* MAXIMA stud zinc coated st.	Code* MAXIMA stud 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										055887	

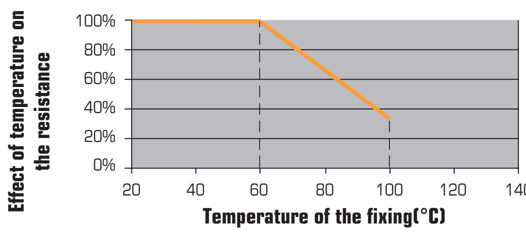
* These are Maxima studs, for standard studs (zinc coated or stainless steel versions) see catalogue.

Anchor mechanical properties

Anchor size		M8	M10	M12	M16	M20	M24	M30
MAXIMA stud - zinc coated steel version								
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
$M^0_{rk,s}$ (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
MAXIMA stud - stainless steel A4 version								
f_{uk} (N/mm²)	Min. tensile strength	700	700	700	700	700	700	-
f_{yk} (N/mm²)	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 (mm²)	Stressed cross-section	36,6	58	84,3	157	227	326,9	-
W_{el} (mm³)	Elastic section modulus	31,2	62,3	109,2	277,5	482,4	833,7	-

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
Sulfuric acid	10	(o)
Hydrochloric acid	10	(o)
Nitric acid	10	(o)
Acetic acid	10	(o)
Ammonium hydroxide	10	(o)
Sodium Hypochlorite	5	(o)
Sodium hydroxide	50	(o)
Acetone		(-)
Toluene		(o)
Ethanol		(o)
Methyl-ethyl-ketone (MEK)		(-)
Methanol		(-)
Demineralized water		(+)
Sea water	100	(+)
Engine Petrol	100	(+)
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.

EPCON C8 XTREM

 STANDARD EMBEDMENT - Zinc coated & stainless steel studs

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							
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
Non-cracked concrete							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
$N_{Ru,m}$	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
Cracked concrete							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
$N_{Ru,m}$	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

$$N_{Rd} = \frac{N_{Rk}^{*}}{\gamma_{Mc}}$$

*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							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
N_{Rd}	17,8	25,1	36,8	52,1	83,2	117,4	183,6
Cracked concrete							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
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

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

*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							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
N_{rec}	12,7	17,9	26,3	37,2	59,4	83,8	131,1
Cracked concrete							
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
N_{rec}	8,3	11,5	16,7	25,2	42,5	62,6	103,6

$\gamma_{Mc} = 1,8$

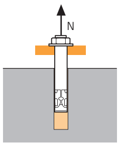
SHEAR

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



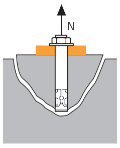
Pull-out resistance for dry and wet concrete [1]

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

$N^0_{Rd,p}$ — **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	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

$\gamma_{Mc} = 1{,}8$



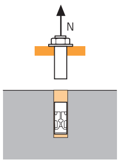
Concrete cone resistance for dry and wet concrete [1]

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
Non-cracked concrete	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

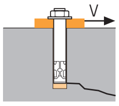
MAXIMA stud A4 : $\gamma_{Ms} = 1{,}87$

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.

[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



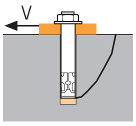
Concrete edge resistance

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

$V^0_{Rd,c}$ — **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	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

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



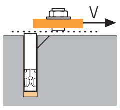
Pryout failure

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
Non-cracked concrete	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.

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

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

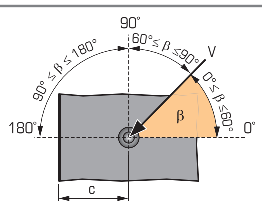
$$\beta_N + \beta_V \leq 1{,}2$$

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

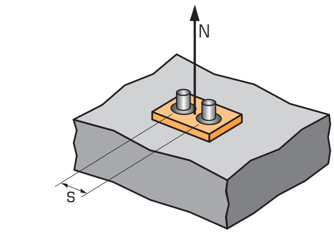
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

Angle 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.

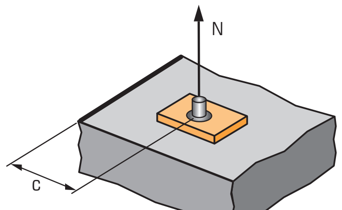
SPACING S — Reduction factor Ψ_s — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16
40	0,58			
50	0,60	0,59		
60	0,63	0,61	0,59	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 Ψ_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	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.

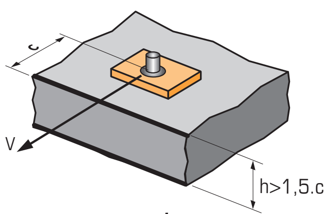
EDGE C — Reduction factor $\Psi_{c,N}$ — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16
40	0,50			
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

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

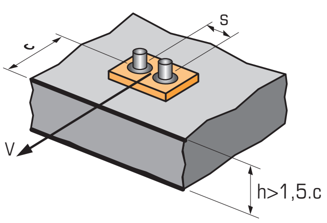


$$\Psi_{s\text{-}c,V} = \frac{c}{c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

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

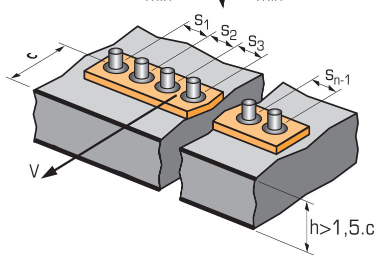


$$\Psi_{s\text{-}c,V} = \frac{3.c + s}{6.c_{min}} . \sqrt{\frac{c}{c_{min}}}$$

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



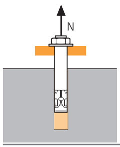
For 3 anchors fastening and more

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

Chemical anchors

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

TENSILE in kN

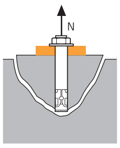


Pull-out resistance

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

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

[1] when more than one anchor of the group is submitted to tensile load
$\gamma_{Mc} = 1,8$

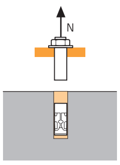


Concrete cone resistance

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

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

[1] when more than one anchor of the group is submitted to tensile load
$\gamma_{Mc} = 1,8$

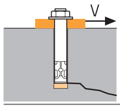


Steel resistance

$N_{Rd,s,C1}$	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

[1] 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 : $\gamma_{Ms} = 1,5$

SHEAR in kN

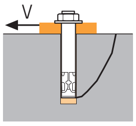


Concrete edge resistance

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

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

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

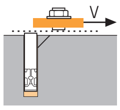


Pryout failure

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

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

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



Steel resistance [2]

$V_{Rd,s,C1}$	Steel design shear resistance		
Anchor size	M10	M12	M16
Category C1 - Single anchor			
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
Category C1 - Group of anchors [1]			
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

[1] when more than one anchor of the group is submitted to shear load
[2] 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 : $\gamma_{Ms} = 1,25$

$$N_{Rd,C1} = \min(N_{Rd,p,C1} \,;\, N_{Rd,c,C1} \,;\, N_{Rd,s,C1})$$
$$\beta_N = N_{Sd} / N_{Rd,C1} \leq 1$$

$$V_{Rd,C1} = \min(V_{Rd,c,C1} \,;\, V_{Rd,cp,C1} \,;\, V_{Rd,s,C1})$$
$$\beta_V = V_{Sd} / V_{Rd,C1} \leq 1$$

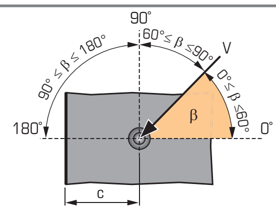
$$\beta_N + \beta_V \leq 1,2$$

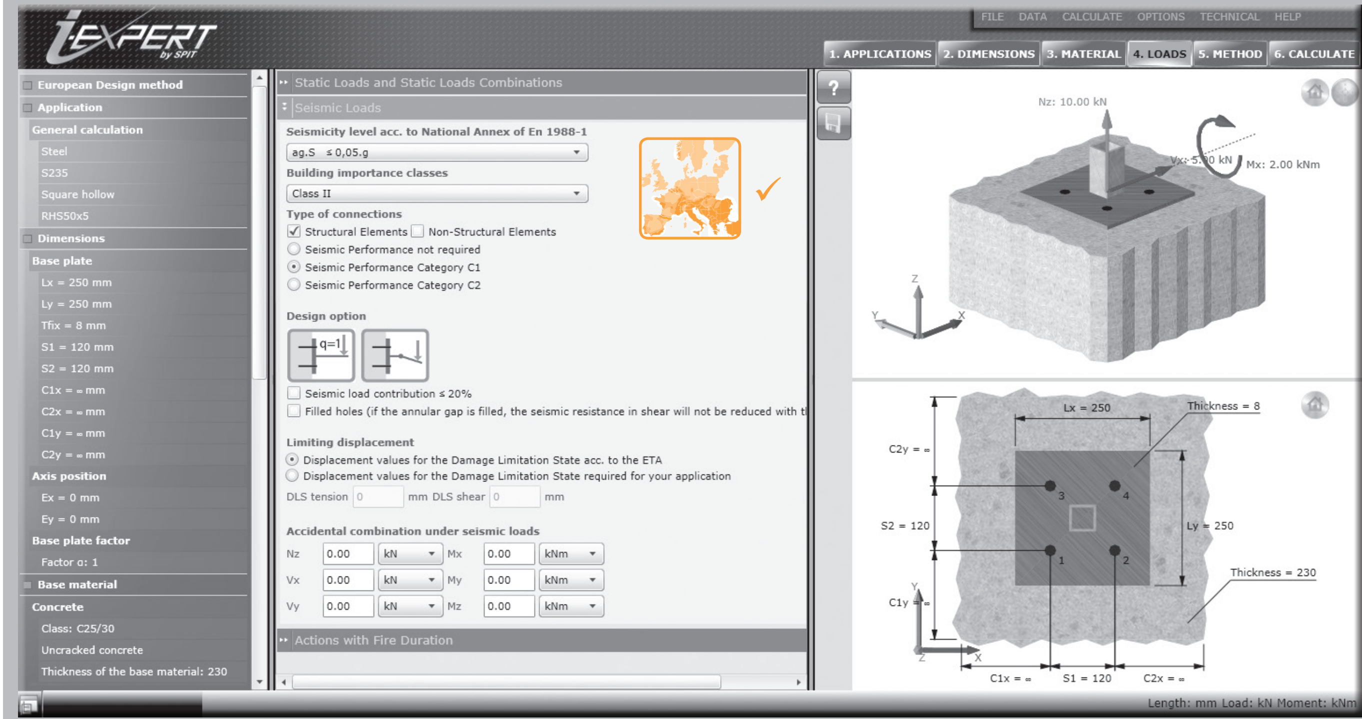
f_b INFLUENCE OF CONCRETE

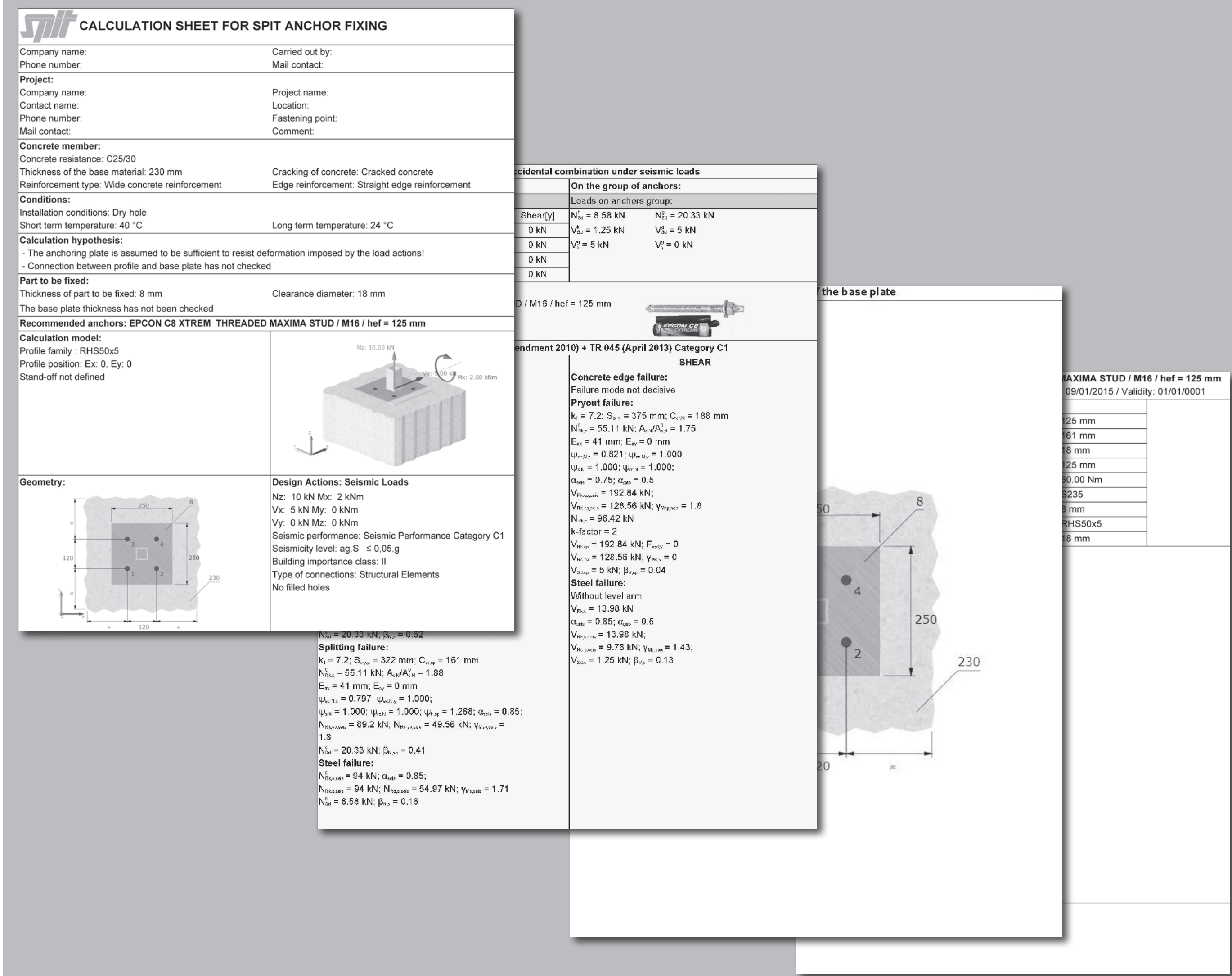
Concrete class	f_b
C25/30	1,02
C30/40	1,08
C40/60	1,10
C50/60	1,12

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

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



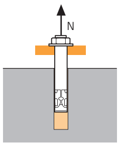




Chemical anchors

SPIT CC Method (values issued from ETA)

TENSILE in kN

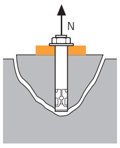


Pull-out resistance for dry and wet concrete [1]

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

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

$\gamma_{Mc} = 1{,}8$

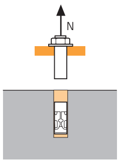


Concrete cone resistance for dry and wet concrete [1]

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

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

$\gamma_{Mc} = 1{,}8$



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

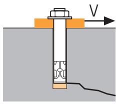
MAXIMA stud A4 : $\gamma_{Ms} = 1{,}87$

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.

[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

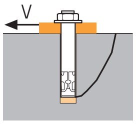


Concrete edge resistance

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

$V^0_{Rd,c}$	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	50	60	80	100	120	150
S_{min}	40	50	60	80	100	120	150
Non-cracked concrete	2,6	3,5	5,1	7,5	12,7	18,9	32,2
Cracked concrete	1,8	2,5	3,6	5,3	9	13,5	23

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

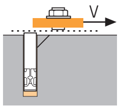


Pryout failure

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

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

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



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.

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

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

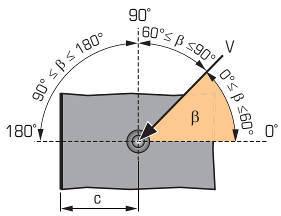
$$\beta_N + \beta_V \leq 1{,}2$$

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

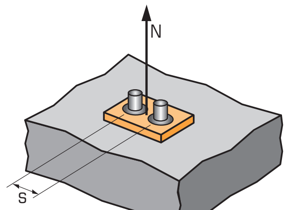
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

Angle 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



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

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

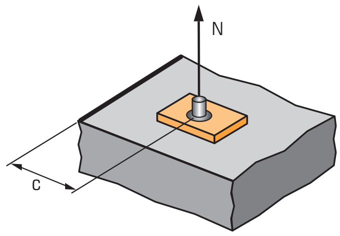
$s_{cr,N} = 3.h_{ef}$

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	0,57			
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_s 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

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



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

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

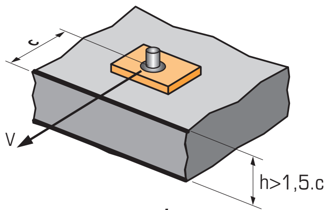
$c_{cr,N} = 1{,}5.h_{ef}$

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

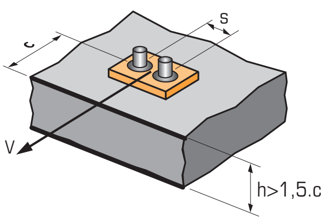
EDGE C	Reduction factor $\Psi_{c,N}$ Cracked & non-cracked concrete			
Anchor size	M8	M10	M12	M16
40	0,46			
50	0,51	0,46		
60	0,57	0,50	0,46	
80	0,67	0,58	0,53	0,46
145	1,00	0,85	0,75	0,63
180		1,00	0,88	0,72
215			1,00	0,81
290				1,00

EDGE C	Reduction factor $\Psi_{c,N}$ 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

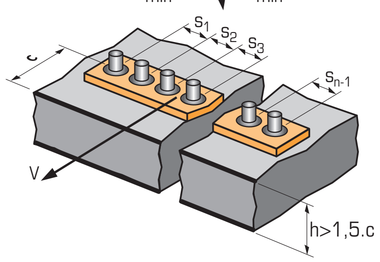
$\Psi_{s\text{-}c,V}$ INFLUENCE OF SPACING AND EDGE DISTANCE FOR CONCRETE EDGE RESISTANCE IN SHEAR LOAD



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



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



¬ For single anchor fastening

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

c/c_{min}	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2
$\Psi_{s\text{-}c,V}$	1,00	1,31	1,66	2,02	2,41	2,83	3,26	3,72	4,19	4,69	5,20	5,72

¬ For 2 anchors fastening

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

s/c_{min} \ c/c_{min}	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2
1,0	0,67	0,84	1,03	1,22	1,43	1,65	1,88	2,12	2,36	2,62	2,89	3,16
1,5	0,75	0,93	1,12	1,33	1,54	1,77	2,00	2,25	2,50	2,76	3,03	3,31
2,0	0,83	1,02	1,22	1,43	1,65	1,89	2,12	2,38	2,63	2,90	3,18	3,46
2,5	0,92	1,11	1,32	1,54	1,77	2,00	2,25	2,50	2,77	3,04	3,32	3,61
3,0	1,00	1,20	1,42	1,64	1,88	2,12	2,37	2,63	2,90	3,18	3,46	3,76
3,5		1,30	1,52	1,75	1,99	2,24	2,50	2,76	3,04	3,32	3,61	3,91
4,0			1,62	1,86	2,10	2,36	2,62	2,89	3,17	3,46	3,75	4,05
4,5				1,96	2,21	2,47	2,74	3,02	3,31	3,60	3,90	4,20
5,0					2,33	2,59	2,87	3,15	3,44	3,74	4,04	4,35
5,5						2,71	2,99	3,28	3,71	4,02	4,33	4,65
6,0						2,83	3,11	3,41	3,71	4,02	4,33	4,65

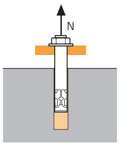
¬ For 3 anchors fastening and more

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

Chemical anchors

SPIT CC Method (values issued from ETA)

TENSILE in kN



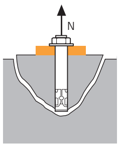
Pull-out resistance for dry and wet concrete [1]

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**128**	**160**	**192**	**256**	**320**	**384**	**480**
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

$\gamma_{Mc} = 1,8$



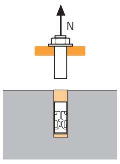
Concrete cone resistance for dry and wet concrete [1]

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

$N^0_{Rd,c}$ — Design cone resistance

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**128**	**160**	**192**	**256**	**320**	**384**	**480**
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

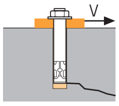
$N_{Rd,s}$ — Steel design tensile resistance

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.

[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



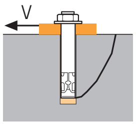
Concrete edge resistance

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**128**	**160**	**192**	**256**	**320**	**384**	**480**
C_{min}	40	50	60	80	100	120	150
S_{min}	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

$\gamma_{Mc} = 1,5$



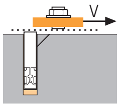
Pryout failure

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**128**	**160**	**192**	**256**	**320**	**384**	**480**
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

$V_{Rd,s}$ — 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.

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

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

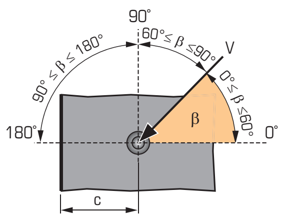
$$\beta_N + \beta_V \leq 1,2$$

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

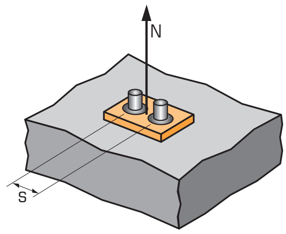
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

Angle 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.

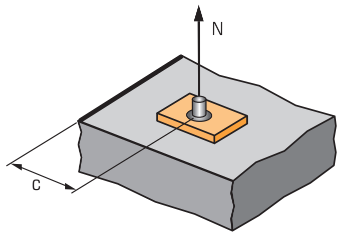
SPACING S — Reduction factor Ψ_s — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16
40	0,55			
50	0,57	0,55		
60	0,58	0,56	0,55	0,54
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_s — 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

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



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

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

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

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

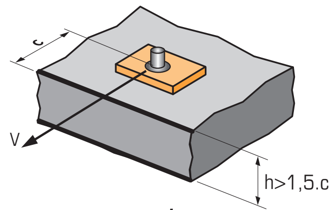
EDGE C — Reduction factor $\Psi_{c,N}$ — Cracked & non-cracked concrete

Anchor size	M8	M10	M12	M16
40	0,41			
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 $\Psi_{c,N}$ — 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

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

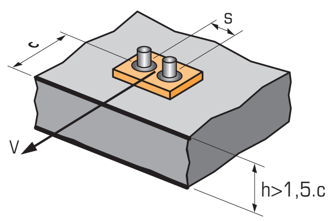


$$\Psi_{s\text{-}c,V} = \frac{c}{c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$

For single anchor fastening

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

$\frac{c}{c_{min}}$	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

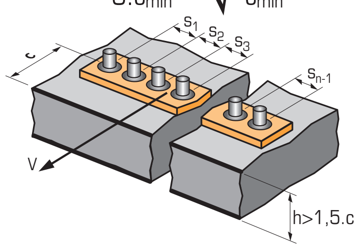


$$\Psi_{s\text{-}c,V} = \frac{3.c + s}{6.c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$

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

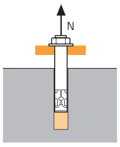


For 3 anchors fastening and more

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

SPIT CC Method (values issued from ETA)

TENSILE in kN



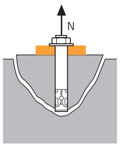
Pull-out resistance for dry and wet concrete [1]

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	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

$\gamma_{Mc} = 1,8$



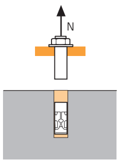
Concrete cone resistance for dry and wet concrete [1]

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	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

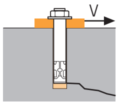
Std. stud grade 5.8 and 8.8 : $\gamma_{Ms} = 1,5$

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

* Special grade available on request.

[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



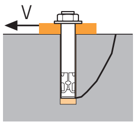
Concrete edge resistance

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	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

$\gamma_{Mc} = 1,5$



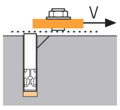
Pryout failure

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

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

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	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.

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

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

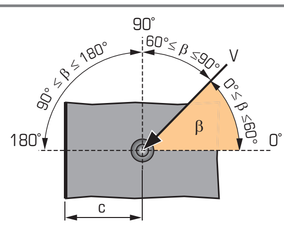
$$\beta_N + \beta_V \leq 1,2$$

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

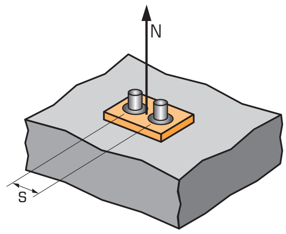
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

Angle 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



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

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

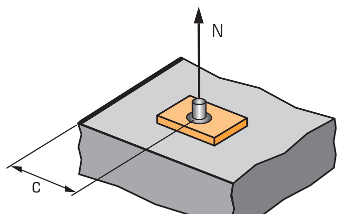
$s_{cr,N} = 3.h_{ef}$

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	0,54			
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 Ψ_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



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

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

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

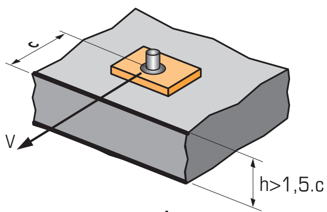
$\Psi_{c,N}$ must be used for each distance influenced the anchors group.

EDGE C	Reduction factor $\Psi_{c,N}$ Cracked & non-cracked concrete			
Anchor size	M8	M10	M12	M16
40	0,38			
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

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

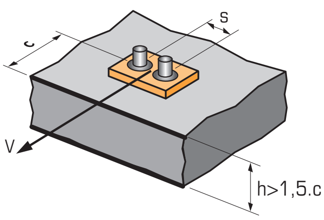


$$\Psi_{s\text{-}c,V} = \frac{c}{c_{min}} \,.\, \sqrt{\frac{c}{c_{min}}}$$

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

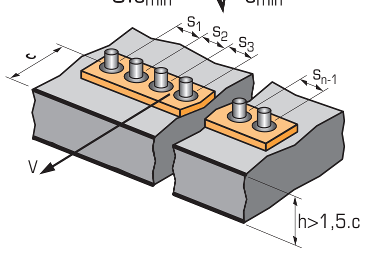


$$\Psi_{s\text{-}c,V} = \frac{3.c + s}{6.c_{min}} \,.\, \sqrt{\frac{c}{c_{min}}}$$

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

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