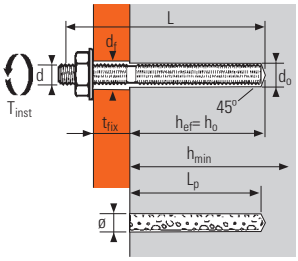
MAXIMA 7

Zinc Coated Anchor Stud (G5.8)

Bonded Anchor in Glass Capsule

Performance	Material	Installation
		

ETA Option 7
n° 03/0007



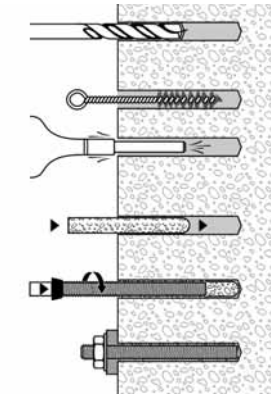
MATERIAL
Stud:
Grade 5.8

Hexagonal nut:
Grade 6 or 8

Washer:
Steel

Coating:
Zinc coated (5µm)

INSTALLATION



Technical Data

MAXIMA 7	Anchor depth (mm)	Max thick of fixture (mm)	Drill depth (mm)	Min thick of base material (mm)	Ø Thread (mm)	Ø Drill bit (mm)	Total anchor length (mm)	Max tighten torque (Nm)	Chemset stud code	Ramset power tool code	Drill bit type-size
	h_{ef}	t_{fix}	h_o	h_{min}	d	d_o	L	T_{inst}			
MAXIMA M8	80	15	80	120	8	10	110	10	CS08110	DD527	R3 PLUS-10
MAXIMA M10	90	20	90	130	10	12	130	20	CS10130	DD527	R3 PLUS-12
MAXIMA M12	110	25	110	160	12	14	160	30	CS12160	DD527	R3 PLUS-14
MAXIMA M16	125	35	125	175	16	18	190	60	CS16190	DD543	R3 PLUS-18
MAXIMA M20	170	65	170	220	20	25	260	120	CS20260	DD565	R3 MAX-25
MAXIMA M24	210	63	210	270	24	28	300	200	CS24300	DD565	R3 MAX-28
MAXIMA M30	280	70	280	340	30	35	380	400	CS30380	DD565	R3 MAX-35

Anchor Mechanical Properties

CARBON STEEL Grade 5.8	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$\mathbf{f_{uk}}$ (N/mm²) Min. tensile strength	540	540	540	520	520	520	520
$\mathbf{f_{yk}}$ (N/mm²) Yield strength	430	430	430	420	420	420	420
$\mathbf{A_s}$ (mm²) Stressed cross-section	36.6	58.0	84.3	157.0	245.0	353.0	522.8
$\mathbf{W_{el}}$ (mm³) Elastic section modulus	31.2	62.3	109.2	277.5	540.9	935.5	1,686.0
$\mathbf{M^0_{Rk,s}}$ (Nm) Characteristic bending moment	20.2	40.4	70.7	173.1	301.1	520.2	1,052.1
M (Nm) Recommended bending moment	16.2	32.3	56.6	138.5	240.8	416.2	841.7

Setting Time before applying load

Ambient temperature (°C)

	Dry concrete Waiting time before apply load	Wet concrete Waiting time before apply load
T ≥ 20°C	20 min	40 min
10°C < T < 20°C	30 min	60 min
0°C < T < 10°C	1 hour	2 hours
-5°C < T < 0°C	5 hours	10 hours

Chemical Resistance of the MAXIMA Anchor

Chemical substances	Concentration (%)	Resistance
Nitric Acid	< 20	1
Phosphoric acid	< 10	1
Sulphuric acid	≤ 30	1
Ethyl alcohol	≤ 15	1
Beer	100	1
Carbon dioxide	100	1
Hydrogen fluoride	≤ 20	1
Ammonia	100	1
Ethylene glycol	100	1
Washing powder	100	1
Cement in suspension	saturated solution	1

Chemical substances	Concentration (%)	Resistance
Carbon monoxide	100	1
Caustic potash	100	1
Nitric Acid	20 - 70	2
Heptane	100	2
Hexane	100	2
Methanol	≤ 15	2
Perchloroethylene	100	2
Hydrogen peroxide	≤ 40	2
Sulphurous acid	100	2
Engine petrol w/o benzene	100	2

1 = High resistance (Anchors could be submerged in these materials)
2 = Medium resistance (Anchors could be temporary submerged due to splash or spill)

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Zinc Coated Anchor Stud (G5.8)

Ultimate Loads ($N_{Ru,m}$, $V_{Ru,m}$) / Characteristic Loads (N_{Rk}, V_{Rk}) in kN

TENSILE @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef} (mm)	80	90	110	125	170	210	280
$N_{Ru,m}$ (kN)	21.3	33.8	49.2	88.2	167.8	231.6	327.5
N_{Rk} (kN)	19.8	31.3	45.5	81.6	125.8	173.7	270.7

SHEAR @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
$V_{Ru,m}$ (kN)	12.8	20.3	29.5	52.9	82.6	118.9	176.2
V_{Rk} (kN)	11.9	18.8	27.3	49.0	76.4	110.1	163.1

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

$$N_{Rd} = \frac{N_{Rk}}{\gamma_{Mc,N}} \qquad V_{Rd} = \frac{V_{Rk}}{\gamma_{Ms,V}}$$

TENSILE @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef} (mm)	80	90	110	125	170	210	280
N_{Rd} (kN)	13.2	20.9	30.3	54.4	69.9	96.5	150.4

$\gamma_{Mc,N} = 1.8$

$\gamma_{Ms,N} = 1.5$ *(steel failure)*

SHEAR @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
V_{Rd} (kN)	9.5	15.0	21.9	39.2	61.2	88.1	130.5

$\gamma_{Ms,V} = 1.25$

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

$$N_{rec} = \frac{N_{Rk}}{\gamma_{Mc,N} \cdot \gamma_F} \qquad V_{rec} = \frac{V_{Rk}}{\gamma_{Ms,V} \cdot \gamma_F}$$

TENSILE @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef} (mm)	80	90	110	125	170	210	280
N_{rec} (kN)	9.4	14.9	21.7	38.9	49.9	68.9	107.4

$\gamma_F = 1.4$

$\gamma_{Mc,N} = 1.8$

$\gamma_{Ms,N} = 1.5$ *(steel failure)*

SHEAR @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
V_{rec} (kN)	6.8	10.7	15.6	28.0	43.7	62.9	93.2

$\gamma_F = 1.4$

$\gamma_{Ms,V} = 1.25$

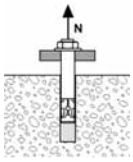
steel failure

MAXIMA 7

Zinc Coated Anchor Stud (G5.8)

CC-Method

TENSILE in kN



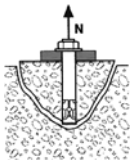
Pull-out resistance
Concrete strength 30 N/mm²

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

$N^0_{Rd,p}$	Design resistance in dry and wet concrete						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
h_{ef} (mm)	80	90	110	125	170	210	280
$N^0_{Rd,p}$ (kN)	11.9	20.2	30.8	42.7	69.9	96.5	150.4

$N^0_{Rd,p}$	Design resistance in flooded concrete						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$N^0_{Rd,p}$ (kN)	8.5	14.4	22.0	30.5	49.9	68.9	107.4

$\gamma_{Mc,N}$ = 1.8
$\gamma_{Mc,N}$ = 2.52 (flooded)



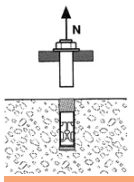
Concrete cone resistance for dry (1), wet (2) and flooded (3) concrete

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

$N^0_{Rd,p}$	Design resistance in dry and wet concrete						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
h_{ef} (mm)	80	90	110	125	170	210	280
$N^0_{Rd,c}$ (kN)	26.3	31.4	42.5	51.4	81.6	112.0	172.5

$N^0_{Rd,p}$	Design resistance in flooded concrete						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$N^0_{Rd,c}$ (kN)	15.7	18.7	25.3	30.6	48.6	66.7	102.6

$\gamma_{Mc,N}$ = 1.5
$\gamma_{Mc,N}$ = 2.52 (flooded)

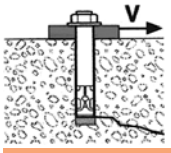


Steel resistance

$N_{Rd,s}$	Steel design tensile resistance						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$N_{Rd,s}$ (kN)	13.2	20.9	30.3	54.4	84.9	122.4	181.2

$\gamma_{Ms,N}$= 1.5

SHEAR in kN

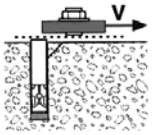


Concrete edge resistance
Concrete strength 30 N/mm²

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

$V^0_{Rd,c}$	Design concrete edge resistance at a minimum edge distance (c_{min})						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
h_{ef} (mm)	80	90	110	125	170	210	280
c_{min}	40	45	55	65	85	105	140
s_{min}	40	45	55	65	85	105	140
$V^0_{Rd,c}$ (kN)	2.8	3.6	5.3	7.5	13.3	19.7	34.3

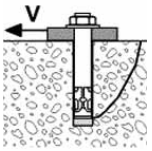
$\gamma_{Mc,V}$ = 1.5



Steel resistance

$V_{Rd,s}$	Steel design shear resistance						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$V_{Rd,s}$ (kN)	9.5	15.0	21.9	39.2	61.2	88.1	130.5

$\gamma_{Ms,V}$ = 1.25



Concrete pry-out failure
Concrete Strength 30 N/mm²

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

$V^0_{Rd,cp}$	Design pry-out resistance						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$V^0_{Rd,cp}$ (kN)	23.5	36.7	58.6	88.0	110.0	168.7	205.4

$\gamma_{Mc,V}$ = 1.5

(1) for dry hole, γ_{Mc} = 2.16 where brush is not use to clean hole
(2) The concrete in the area of the anchorage is water satured.
(3) The concrete is wet, and the is full of water. The resin can be injected without remove water.

$$N_{Rd} = \min (N_{Rd,p} ; N_{Rd,c} ; N_{Rd,s})$$
$$\beta N = N_{Sd} / N_{Rd} \le 1$$

$$V_{Rd} = \min (V_{Rd,c} ; V_{Rd,s} ; V_{Rd,cp})$$
$$\beta V = V_{Sd} / V_{Rd} \le 1$$

$$\beta N + \beta V \le 1.2$$

f_B INFLUENCE OF CONCRETE

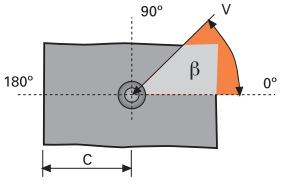
Concrete Grade	f_B	Concrete Grade	f_B
C16/20	0.81	C35/45	1.21
C20/25	0.90	C40/50	1.28
C25/30	1.00	C45/55	1.34
C30/37	1.10	C50/60	1.40

f_T INFLUENCE OF EMBEDMENT DEPTH

$$f_T = \frac{h_{act}}{h_{ef}} \quad \text{where: } h_{ef} \le h_{act} \le 2h_{ef}$$

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

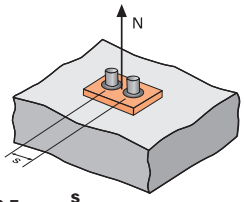
Angle β [°]	$f_{\beta,V}$
0~50	1.0
60	1.1
70	1.2
80	1.5
90~180	2.0



MAXIMA 7
Zinc Coated Anchor Stud (G5.8)

CC-Method

Ψ_s INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



$$\Psi_s = 0.5 + \frac{s}{4h_{ef}}$$

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

$s_{min} = 0.5h_{ef}$

$s_{cr,N} = 2h_{ef}$

Ψ_s must be used for each spacing influenced the anchors group

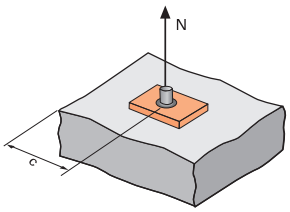
Spacing, s — Reduction Factor Ψ_s — Non-cracked concrete

	M8	M10	M12	M16
40	0.63			
45	0.64	0.63		
55	0.67	0.65	0.63	
65	0.70	0.68	0.65	0.63
85	0.77	0.74	0.69	0.67
105	0.83	0.79	0.74	0.71
140	0.94	0.89	0.82	0.78
160	1.00	0.94	0.86	0.82
180		1.00	0.91	0.86
220			1.00	0.94
250				1.00

Spacing, s — Reduction Factor Ψ_s — Non-cracked concrete

	M20	M24	M30
85	0.63		
105	0.65	0.63	
140	0.71	0.67	0.63
160	0.74	0.69	0.64
180	0.76	0.71	0.66
220	0.82	0.76	0.70
250	0.87	0.80	0.72
300	0.94	0.86	0.77
340	1.00	0.90	0.80
370		0.94	0.83
450		1.00	0.90
560			1.00

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



$$\Psi_{c,N} = 0.275 + 0.725 \cdot \frac{c}{h_{ef}}$$

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

$c_{min} = 0.5h_{ef}$

$c_{cr,N} = h_{ef}$

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

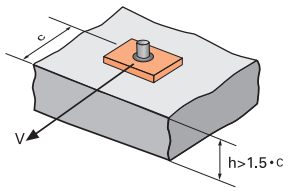
Edge, c — Reduction Factor $\Psi_{c,N}$ — Non-cracked concrete

	M8	M10	M12	M16
40	0.63			
45	0.68	0.63		
55	0.77	0.71	0.63	
65	0.86	0.79	0.70	0.66
80	1.00	0.91	0.80	0.73
90		1.00	0.86	0.79
110			1.00	0.91
125				1.00

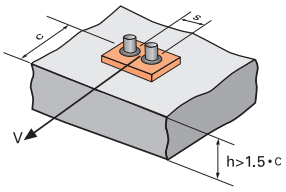
Edge, c — Reduction Factor $\Psi_{c,N}$ — Non-cracked concrete

	M20	M24	M30
85	0.63		
105	0.72	0.63	
120	0.78	0.68	
140	0.87	0.75	0.63
170	1.00	0.86	0.71
210		1.00	0.81
250			0.92
280			1.00

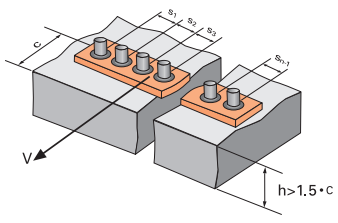
$\Psi_{s\text{-}c,V}$ INFLUENCED OF SPACING AND EDGE DISTANCE FOR CONCRETE EDGE RESISTANCE IN SHEAR LOAD



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



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



FOR SINGLE ANCHOR FASTENING — Reduction Factor $\Psi_{s\text{-}c,V}$ — Non-cracked concrete

$\frac{c}{c_{min}}$	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
$\Psi_{s\text{-}c,V}$	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 $\Psi_{s\text{-}c,V}$ — 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	3.57	3.88	4.19	4.50
6.0						2.83	3.11	3.41	3.71	4.02	4.33	4.65

FOR OTHER CASE OF FASTENINGS

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

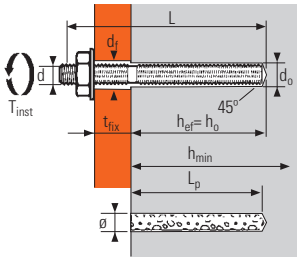
MAXIMA 7

Stainless Steel Anchor Stud (SUS316)

Bonded Anchor in Glass Capsule

Performance	Material	Installation
		

ETA Option 7
n° 03/0008



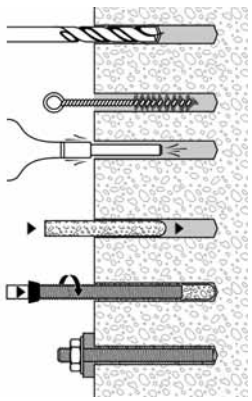
MATERIAL

Stud:
SUS316

Hexagonal nut:
SUS316

Washer:
SUS316

INSTALLATION



Technical Data

MAXIMA 7	Anchor depth (mm)	Max thick of fixture (mm)	Drill depth (mm)	Min thick of base material (mm)	Ø Thread (mm)	Ø Drill bit (mm)	Total anchor length (mm)	Max tighten torque (Nm)	Chemset stud code	Ramset power tool code	Drill bit type-size
	h_{ef}	t_{fix}	h_o	h_{min}	d	d_o	L	T_{inst}			
MAXIMA M8	80	15	80	120	8	10	110	10	CS08110SS	DD527	R3 PLUS-10
MAXIMA M10	90	20	90	130	10	12	130	20	CS10130SS	DD527	R3 PLUS-12
MAXIMA M12	110	25	110	160	12	14	160	30	CS12160SS	DD527	R3 PLUS-14
MAXIMA M16	125	35	125	175	16	18	190	60	CS16190SS	DD543	R3 PLUS-18
MAXIMA M20	170	65	170	220	20	25	260	120	CS20260SS	DD565	R3 MAX-25
MAXIMA M24	210	63	210	270	24	28	300	200	CS24300SS	DD565	R3 MAX-28
MAXIMA M30	280	70	280	340	30	35	380	400	CS30380SS	DD565	R3 MAX-35

Anchor Mechanical Properties

STAINLESS STEEL SUS316	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$\mathbf{f_{uk}}$ (N/mm²) Min. tensile strength	650	650	650	650	650	650	500
$\mathbf{f_{yk}}$ (N/mm²) Yield strength	450	450	450	450	450	450	250
$\mathbf{A_s}$ (mm²) Stressed cross-section	36.6	58.0	84.3	157.0	245.0	353.0	522.8
$\mathbf{W_{el}}$ (mm³) Elastic section modulus	31.2	62.3	109.2	277.5	540.9	935.5	1,686.0
$\mathbf{M^0_{Rk,s}}$ (Nm) Characteristic bending moment	24.3	48.6	85.2	216.5	421.9	729.7	1,011.6
M (Nm) Recommended bending moment	15.7	31.4	55.0	139.6	272.2	364.8	652.6

Setting Time before applying load

Ambient temperature (°C)	Dry concrete Waiting time before apply load	Wet concrete Waiting time before apply load
T ≥ 20°C	20 min	40 min
10°C < T < 20°C	30 min	60 min
0°C < T < 10°C	1 hour	2 hours
-5°C < T < 0°C	5 hours	10 hours

Chemical Resistance of the MAXIMA Anchor

Chemical substances	Concentration (%)	Resistance
Nitric Acid	< 20	1
Phosphoric acid	< 10	1
Sulphuric acid	≤ 30	1
Ethyl alcohol	≤ 15	1
Beer	100	1
Carbon dioxide	100	1
Hydrogen fluoride	≤ 20	1
Ammonia	100	1
Ethylene glycol	100	1
Washing powder	100	1
Cement in suspension	saturated solution	1

Chemical substances	Concentration (%)	Resistance
Carbon monoxide	100	1
Caustic potash	100	1
Nitric Acid	20 - 70	2
Heptane	100	2
Hexane	100	2
Methanol	≤ 15	2
Perchloroethylene	100	2
Hydrogen peroxide	≤ 40	2
Sulphurous acid	100	2
Engine petrol w/o benzene	100	2

1 = High resistance (Anchors could be submerged in these materials)
2 = Medium resistance (Anchors could be temporary submerged due to splash or spill)

MAXIMA 7

Stainless Steel Anchor Stud (SUS316)

Ultimate Loads ($N_{Ru,m}$, $V_{Ru,m}$) / Characteristic Loads (N_{Rk}, V_{Rk}) in kN

TENSILE @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef} (mm)	80	90	110	125	170	210	280
$N_{Ru,m}$ (kN)	25.7	40.7	59.2	102.5	167.8	231.6	327.5
N_{Rk} (kN)	23.8	37.7	54.8	76.9	125.8	173.7	270.7

SHEAR @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
$V_{Ru,m}$ (kN)	15.4	24.4	35.5	66.1	103.2	148.7	169.4
V_{Rk} (kN)	14.3	22.6	32.9	61.2	95.6	137.7	156.8

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

$$N_{Rd} = \frac{N_{Rk}}{\gamma_{Mc,N}} \qquad V_{Rd} = \frac{V_{Rk}}{\gamma_{Ms,V}}$$

TENSILE @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef} (mm)	80	90	110	125	170	210	280
N_{Rd} (kN)	15.4	24.3	35.4	42.7	69.9	96.5	150.4

$\gamma_{Mc,N}$ = 1.8

$\gamma_{Ms,N}$ = 1.55 *(steel failure)* for M8 to M24

SHEAR @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
V_{Rd} (kN)	9.2	14.6	21.2	39.5	61.6	88.8	78.4

$\gamma_{Ms,V}$ = 1.55 for M8 to M24

$\gamma_{Ms,V}$ = 2.00 for M30

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

$$N_{rec} = \frac{N_{Rk}}{\gamma_{Mc,N} \cdot \gamma_F} \qquad V_{rec} = \frac{V_{Rk}}{\gamma_{Ms,V} \cdot \gamma_F}$$

TENSILE @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef} (mm)	80	90	110	125	170	210	280
N_{rec} (kN)	11.0	17.4	25.3	30.5	49.9	68.9	107.4

γ_F = 1.4

$\gamma_{Mc,N}$ = 1.8

$\gamma_{Ms,N}$ = 1.55 *(steel failure)* for M8 to M24

SHEAR @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16	M20	M24	M30
V_{rec} (kN)	6.6	10.4	15.2	28.2	44.0	63.4	56.0

γ_F = 1.4

$\gamma_{Ms,V}$ = 1.55 for M8 to M24

$\gamma_{Ms,V}$ = 2.00 for M30

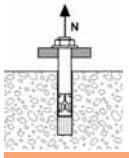
steel failure

MAXIMA 7

Stainless Steel Anchor Stud (SUS316)

CC-Method

TENSILE in kN



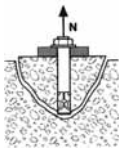
Pull-out resistance
Concrete strength 30 N/mm²

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

$N^0_{Rd,p}$	Design resistance in dry and wet concrete						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
h_{ef} (mm)	80	90	110	125	170	210	280
$N^0_{Rd,p}$ (kN)	11.9	20.2	30.8	42.7	69.9	96.5	150.4

$N^0_{Rd,p}$	Design resistance in flooded concrete						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$N^0_{Rd,p}$ (kN)	8.5	14.4	22.0	30.5	49.9	68.9	107.4

$\gamma_{Mc,N}$ = 1.8
$\gamma_{Mc,N}$ = 2.52 (flooded)



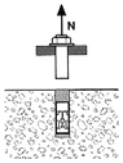
Concrete cone resistance for dry (1), wet (2) and flooded (3) concrete

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

$N^0_{Rd,p}$	Design resistance in dry and wet concrete						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
h_{ef} (mm)	80	90	110	125	170	210	280
$N^0_{Rd,c}$ (kN)	26.3	31.4	42.5	51.4	81.6	112.0	172.5

$N^0_{Rd,p}$	Design resistance in flooded concrete						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$N^0_{Rd,c}$ (kN)	15.7	18.7	25.3	30.6	48.6	66.7	102.6

$\gamma_{Mc,N}$ = 1.5
$\gamma_{Mc,N}$ = 2.52 (flooded)

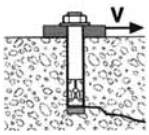


Steel resistance

$N_{Rd,s}$	Steel design tensile resistance						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$N_{Rd,s}$ (kN)	15.4	24.3	35.4	65.9	102.8	148.1	130.7

$\gamma_{Ms,N}$ = 1.55 for M8 to M24
$\gamma_{Ms,N}$ = 2.00 for M30

SHEAR in kN

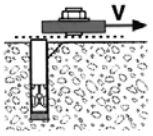


Concrete edge resistance
Concrete strength 30 N/mm²

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

$V^0_{Rd,c}$	Design concrete edge resistance at a minimum edge distance (c_{min})						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
h_{ef} (mm)	80	90	110	125	170	210	280
c_{min}	40	45	55	65	85	105	140
s_{min}	40	45	55	65	85	105	140
$V^0_{Rd,c}$ (kN)	2.8	3.6	5.3	7.5	13.3	19.7	34.3

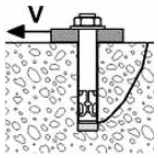
$\gamma_{Mc,V}$ = 1.5



Steel resistance

$V_{Rd,s}$	Steel design shear resistance						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$V_{Rd,s}$ (kN)	9.2	14.6	21.2	39.5	61.6	88.8	78.4

$\gamma_{Ms,V}$ = 1.55 for M8 to M24
$\gamma_{Ms,V}$ = 2.00 for M30



Concrete pry-out failure
Concrete Strength 30 N/mm²

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

$V^0_{Rd,cp}$	Design pry-out resistance						
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M30**
$V^0_{Rd,cp}$ (kN)	23.5	36.7	58.6	88.0	110.0	168.7	205.4

$\gamma_{Mc,V}$ = 1.5

(1) for dry hole, γ_{Mc} = 2.16 where brush is not use to clean hole
(2) The concrete in the area of the anchorage is water satured.
(3) The concrete is wet, and the is full of water. The resin can be injected without remove water.

$$N_{Rd} = \min (N_{Rd,p} ; N_{Rd,c} ; N_{Rd,s})$$
$$\beta N = N_{Sd} / N_{Rd} \le 1$$

$$V_{Rd} = \min (V_{Rd,c} ; V_{Rd,s} ; V_{Rd,cp})$$
$$\beta V = V_{Sd} / V_{Rd} \le 1$$

$$\beta N + \beta V \le 1.2$$

f_B INFLUENCE OF CONCRETE

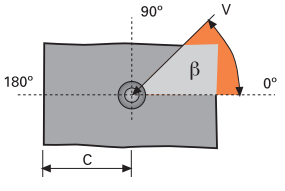
Concrete Grade	f_B	Concrete Grade	f_B
C16/20	0.81	C35/45	1.21
C20/25	0.90	C40/50	1.28
C25/30	1.00	C45/55	1.34
C30/37	1.10	C50/60	1.40

f_T INFLUENCE OF EMBEDMENT DEPTH

$$f_T = \frac{h_{act}}{h_{ef}} \quad \text{where: } h_{ef} \le h_{act} \le 2h_{ef}$$

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

Angle β [°]	$f_{\beta,V}$
0~50	1.0
60	1.1
70	1.2
80	1.5
90~180	2.0

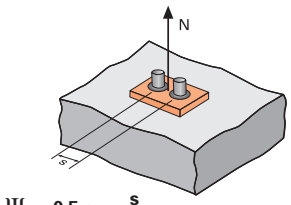


MAXIMA 7

Stainless Steel Anchor Stud (SUS316)

CC-Method

Ψ_s INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



$$\Psi_s = 0.5 + \frac{s}{4h_{ef}}$$

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

$s_{min} = 0.5h_{ef}$

$s_{cr,N} = 2h_{ef}$

Ψ_s must be used for each spacing influenced the anchors group

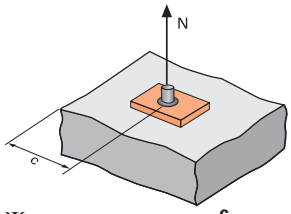
Spacing, s — Reduction Factor Ψ_s Non-cracked concrete

	M8	M10	M12	M16
40	0.63			
45	0.64	0.63		
55	0.67	0.65	0.63	
65	0.70	0.68	0.65	0.63
85	0.77	0.74	0.69	0.67
105	0.83	0.79	0.74	0.71
140	0.94	0.89	0.82	0.78
160	1.00	0.94	0.86	0.82
180		1.00	0.91	0.86
220			1.00	0.94
250				1.00

Spacing, s — Reduction Factor Ψ_s Non-cracked concrete

	M20	M24	M30
85	0.63		
105	0.65	0.63	
140	0.71	0.67	0.63
160	0.74	0.69	0.64
180	0.76	0.71	0.66
220	0.82	0.76	0.70
250	0.87	0.80	0.72
300	0.94	0.86	0.77
340	1.00	0.90	0.80
370		0.94	0.83
450		1.00	0.90
560			1.00

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



$$\Psi_{c,N} = 0.275 + 0.725 \cdot \frac{c}{h_{ef}}$$

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

$c_{min} = 0.5h_{ef}$

$c_{cr,N} = h_{ef}$

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

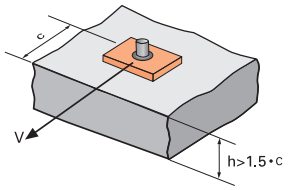
Edge, c — Reduction Factor $\Psi_{c,N}$ Non-cracked concrete

	M8	M10	M12	M16
40	0.63			
45	0.68	0.63		
55	0.77	0.71	0.63	
65	0.86	0.79	0.70	0.66
80	1.00	0.91	0.80	0.73
90		1.00	0.86	0.79
110			1.00	0.91
125				1.00

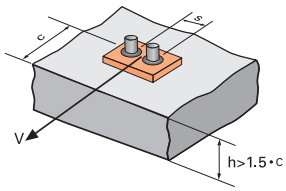
Edge, c — Reduction Factor $\Psi_{c,N}$ Non-cracked concrete

	M20	M24	M30
85	0.63		
105	0.72	0.63	
120	0.78	0.68	
140	0.87	0.75	0.63
170	1.00	0.86	0.71
210		1.00	0.81
250			0.92
280			1.00

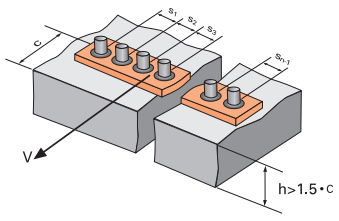
$\Psi_{s-c,V}$ INFLUENCED OF SPACING AND EDGE DISTANCE FOR CONCRETE EDGE RESISTANCE IN SHEAR LOAD



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



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



FOR SINGLE ANCHOR FASTENING — Reduction Factor $\Psi_{s-c,V}$ Non-cracked concrete

$\frac{c}{c_{min}}$	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
$\Psi_{s-c,V}$	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72

FOR 2 ANCHORS FASTENING — Reduction Factor $\Psi_{s-c,V}$ Non-cracked concrete

$\frac{s}{c_{min}}$ \ $\frac{c}{c_{min}}$	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
1.0	0.67	0.84	1.03	1.22	1.43	1.65	1.88	2.12	2.36	2.62	2.89	3.16
1.5	0.75	0.93	1.12	1.33	1.54	1.77	2.00	2.25	2.50	2.76	3.03	3.31
2.0	0.83	1.02	1.22	1.43	1.65	1.89	2.12	2.38	2.63	2.90	3.18	3.46
2.5	0.92	1.11	1.32	1.54	1.77	2.00	2.25	2.50	2.77	3.04	3.32	3.61
3.0	1.00	1.20	1.42	1.64	1.88	2.12	2.37	2.63	2.90	3.18	3.46	3.76
3.5		1.30	1.52	1.75	1.99	2.24	2.50	2.76	3.04	3.32	3.61	3.91
4.0			1.62	1.86	2.10	2.36	2.62	2.89	3.17	3.46	3.75	4.05
4.5				1.96	2.21	2.47	2.74	3.02	3.31	3.60	3.90	4.20
5.0					2.33	2.59	2.87	3.15	3.44	3.74	4.04	4.35
5.5						2.71	2.99	3.28	3.57	3.88	4.19	4.50
6.0						2.83	3.11	3.41	3.71	4.02	4.33	4.65

FOR OTHER CASE OF FASTENINGS

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