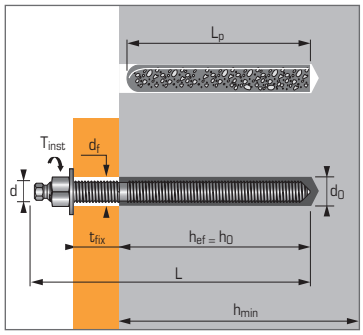
Bonded anchor in glass capsule - heavy loads, for use in non-cracked concrete

ETA Option 7-18/0197



APPLICATION

- Fixing steel framed structures
- Fixing machinery
- Fixing of storage silos
  refinery pipework supports
- Fixing motorway signs
- Fixing safety barriers

MATERIAL

Zinc coated steel version :

- **Stud M8-M30 :**

Steel grade 5.8 as per ISO 898-1

- **Nut :** Steel grade 6 or 8
  NF EN 20898-2
- **Washer :** Steel DIN 513
- **Protection :** zinc coated 5 µm min.
  NF E25-009

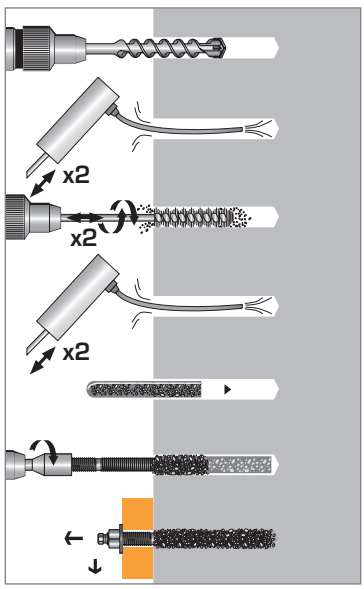
Stainless steel version :

- **Stud M8-M24:**

A4-70 as per ISO 3506-1

- **Nut :** Stainless steel A4-80,
  NF EN 10088-3
- **Washer :** Stainless steel A4,
  NF EN 20898-2

INSTALLATION



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 Ø (mm) d	Drilling depth (mm) h_0	Drilling Ø (mm) d_0	Clearance Ø (mm) d_f	Total stud length (mm) L	Total capsule length (mm) L_p	Tighten torque (Nm) T_{inst}	Code SPIT threaded studs zinc coated st.	Code SPIT threaded studs stainless st. A4	Code capsules
M8X110	80	15	110	8	80	10	9	110	80	10	060215	060222	060204
M10X130	90	20	120	10	90	12	12	130	80	20	060216	060223	060205
M12X160	110	25	140	12	110	14	14	160	95	40	060217	060224	060206
M16X190	125	35	160	16	125	18	18	190	95	80	060218	060225	060207
M20X260	170	65	220	20	170	22	22	260	160	120	060219	060226	060208
M24X300	210	63	265	24	210	26	26	300	175	180	060220	060227	060209
M30X380	280	70	350	30	280	32	33	380	230	300	060221	-	060210

Anchor mechanical properties

Anchor size		M8	M10	M12	M16	M20	M24	M30
As (mm^2)	Stressed cross-section	36,6	58,0	84,3	157,0	227,0	330,0	530,0
W_{el} (mm^3)	Elastic section modulus	31,2	62,3	109,2	277,5	482,4	845,5	1721,0
SPIT Zinc coated steel stud, grade 5.8								
f_{uk} (N/mm^2)	Min. tensile strength	520	520	520	520	520	520	520
f_{yk} (N/mm^2)	Yield strength	420	420	420	420	420	420	420
$M^0_{rk,s}$ (Nm)	Characteristic bending moment	19,5	39,0	68,0	173,0	301,0	528,0	1074,0
M (Nm)	Recommended bending moment	8,0	15,9	27,8	70,7	122,9	215,4	438,3
SPIT Stainless steel stud, A4-70								
f_{uk} (N/mm^2)	Min. tensile strength	700	700	700	700	700	700	-
f_{yk} (N/mm^2)	Yield strength	350	350	350	350	350	350	-
$M^0_{rk,s}$ (Nm)	Characteristic bending moment	26,2	52,3	91,7	233,1	405,2	710,3	-
M (Nm)	Recommended bending moment	10,7	21,4	37,4	95,1	165,4	289,9	-

Setting time

Temperature	Curing time	
	Dry concrete	Wet concrete
T ≥ 30°C	10 min.	20 min.
5°C < T ≤ 20°C	20 min.	40 min.
0°C < T ≤ 5°C	1 hour	2 hours
≥ 0°C	5 hours	10 hours

MAXIMA+

2/4 Threaded stud zinc coated & stainless steel versions

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 (3/4 and 4/4).

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
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
$N_{Ru,m}$	19,9	31,7	45,2	77,9	148,5	209,3	328,8
N_{Rk}	18,0	29,0	42,0	75,4	117,5	174,2	263,9

SHEAR

Anchor size	M8	M10	M12	M16	M20	M24	M30
$V_{Ru,m}$	10,8	16,8	25,2	46,8	73,2	105,6	168
V_{Rk}	9,0	14,0	21,0	39,0	61,0	88,0	140,0

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 (Grade 5.8)

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

TENSILE

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
N_{Rd}	12,0	19,3	28,0	50,3	78,3	116,1	146,6

γ_{Mc} = 1,5 for M8 to M24 and γ_{Mc} = 1,8 for M30

SHEAR

Anchor size	M8	M10	M12	M16	M20	M24	M30
V_{Rd}	7,2	11,2	16,8	31,2	48,8	70,4	112,0

γ_{Ms} = 1,25

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 (Grade 5.8)

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

TENSILE

Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**	**280**
N_{rec}	8,6	13,8	20,0	35,9	56,0	82,9	104,7

γ_F = 1,4 ; γ_{Mc} = 1,5 for M8 to M24 and γ_{Mc} = 1,8 for M30

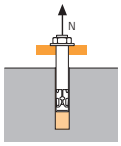
SHEAR

Anchor size	M8	M10	M12	M16	M20	M24	M30
V_{rec}	5,1	8,0	12,0	22,3	34,9	50,3	80,0

γ_F = 1,4 ; γ_{Ms} = 1,25

SPIT CC Method (values issued from ETA)

TENSILE in kN

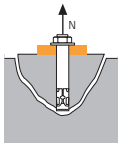


Pull-out resistance for dry, wet [1] concrete

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

$N^0_{Rd,p}$							Design pull-out resistance for dry and wet concrete
Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	80	90	110	125	170	210	280
-40°C to +40°C	16,1	22,6	33,2	50,3	78,3	116,1	146,6
-40°C to +80°C	13,4	18,8	27,6	41,9	67,6	100,3	131,9

γ_{Mc} = 1,5 for M8 to M24 and γ_{Mc} = 1,8 for M30

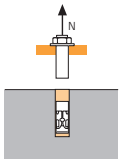


Concrete cone resistance for dry, wet [1] concrete

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

$N^0_{Rd,c}$							Design pull-out resistance for dry and wet concrete
Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	80	90	110	125	170	210	280
-40°C to +80°C	24,0	28,7	38,8	47,0	74,5	102,3	131,2

γ_{Mc} = 1,5 for M8 to M24 and γ_{Mc} = 1,8 for M30



Steel resistance

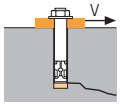
$N_{Rd,s}$							Steel design tensile resistance
Anchor size	M8	M10	M12	M16	M20	M24	M30
Stud Zn. 5.8 grade	12,0	19,3	28,0	52,0	81,3	118,0	186,7
Stud A4-70	13,9	21,4	31,6	58,8	92,0	132,1	-

Stud Zn. 5.8 grade: γ_{Ms} = 1,5

Stud A4-70: γ_{Ms} = 1,87

[1] The concrete in the area of the anchorage is water statured. Water must be evacuated before setting.

SHEAR in kN

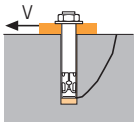


Concrete edge resistance

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

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

γ_{Mc} = 1,5

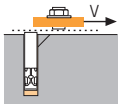


Pryout failure for dry, wet [1] concrete

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

$V^0_{Rd,cp}$							Design pyrout resistance for dry and wet concrete
Anchor size	M8	M10	M12	M16	M20	M24	M30
h_{ef}	80	90	110	125	170	210	280
-40°C to +40°C	32,2	45,2	66,4	93,9	149,0	204,5	314,9
-40°C to +80°C	26,8	37,7	55,3	83,8	135,3	200,6	314,9

γ_{Mcp} = 1,5



Steel resistance

$V_{Rd,s}$							Steel design shear resistance
Anchor size	M8	M10	M12	M16	M20	M24	M30
Stud Zn. 5.8 grade	7,2	11,2	16,8	31,2	48,8	70,4	112,0
Stud A4-70	8,3	12,8	19,2	35,3	55,1	79,5	-

Stud Zn. 5.8 grade: γ_{Ms} = 1,25

Stud A4-70: γ_{Ms} = 1,56

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

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

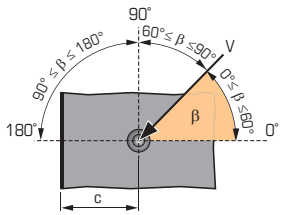
$$\beta_N + \beta_V \leq 1,2$$

f_b INFLUENCE OF CONCRETE

Anchor size	M8 to M30
C25/30	1,06
C30/37	1,14
C50/60	1,34

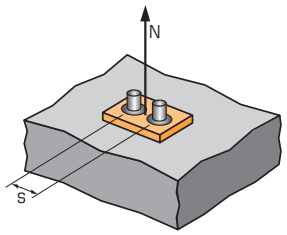
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

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



SPIT CC Method (values issued from ETA)

Ψ_s INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



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

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

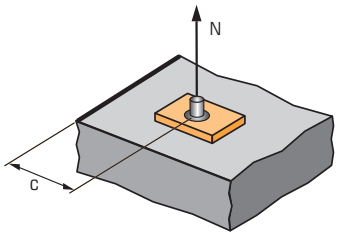
$s_{cr,N} = 2.h_{ef}$

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

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

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



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

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

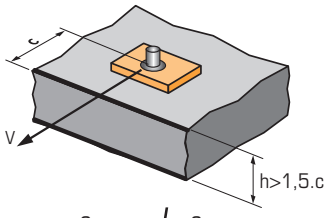
$c_{cr,N} = h_{ef}$

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

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

EDGE C	Reduction factor $\Psi_{c,N}$ Non-cracked concrete		
Anchor size	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

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

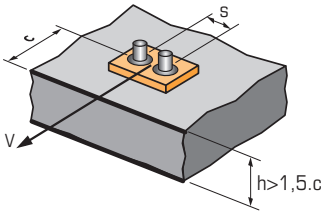


For single anchor fastening

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

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

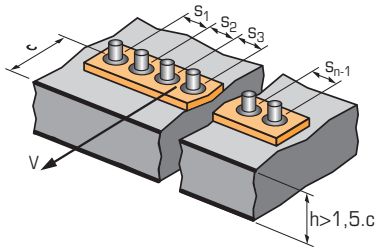


For 2 anchors fastening

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

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	3,71	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

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