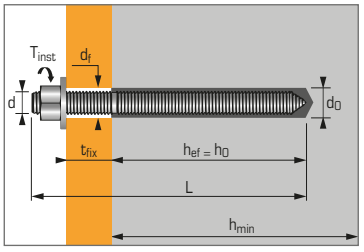
Methacrylate chemical resin for use in non-cracked concrete

ETA Option 7- 13/0435



APPLICATION

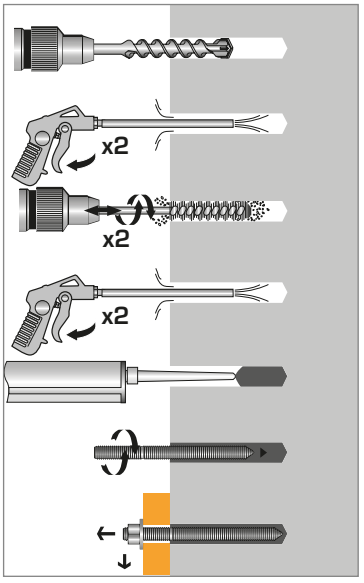
- Fixing steel framed structures
- Fixing machinery (resistant to vibration)
- Fixing of storage silos, refinery pipework supports
- Fixing motorway signs
- Fixing safety barriers

MATERIAL

- **Threaded stud M8-M24**

zinc coated steel version :
steel grade 5.8, 8.8 and 10.9
cold form steel NF A35-053
stainless steel A4 version :
stainless steel A4

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}	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	Tighten torque (Nm) T_{inst}
M8	80	110	8	80	10	9	10
M10	90	120	10	90	12	12	20
M12	110	140	12	110	14	14	30
M16	125	160	16	125	18	18	60
M20	170	220	20	170	25	22	120
M24	210	265	24	210	28	26	200

MULTI-MAX Vinylester resin dual component cartridge 410 ml	Code :	060047
MULTI-MAX Vinylester resin dual component cartridge 280 ml	Code :	060040

Anchor mechanical properties

Anchor size		M8	M10	M12	M16	M20	M24
f_{uk} (N/mm²)	Min. tensile strength	520	520	520	520	520	520
f_{yk} (N/mm²)	Yield strength	420	420	420	420	420	420
$M^0_{rk,s}$ (Nm)	Characteristic bending moment	19,5	38,8	68,1	173,1	337,5	583,7
M (Nm)	Recommended bending moment	9,75	19,4	34,0	86,5	168,7	291,8
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

Temperature	Max. time for installation	Curing time
30°C > T ≥ 40°C	2 min	35 min
20°C > T ≥ 30°C	4 min	45 min
10°C > T ≥ 20°C	6 min	60 min
5°C > T ≥ 10°C	12 min	90 min
0°C > T ≥ 5°C	18 min	180 min
-5°C > T ≥ 0°C	-	360 min

MULTI-MAX

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).

Number of sealings per cartridge

Anchor size	M8	M10	M12	M16	M20	M24
Drilling diameter (mm)	10	12	14	18	25	28
Drilling depth (mm)	80	90	110	125	170	210
Number of sealings per cartridge						
MULTI-MAX 410 ml	109	67	40	21	8	5
MULTI-MAX 280 ml	74	46	28	15	6	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
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**
$N_{Ru,m}$	21,1	29,6	41,1	58,5	99,5	138,3
N_{Rk}	18,1	25,4	35,2	50,3	85,5	118,8

SHEAR

Anchor size	M8	M10	M12	M16	M20	M24
$V_{Ru,m}$	15,92	22,75	32,8	56,2	73,6	115,0
V_{Rk}	10,98	18,9	25,3	46,8	59,02	95,8

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
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**
N_{Rd}	12,1	14,1	19,6	27,9	47,5	66,0

γ_{Mc} = 1,5 for M8 and γ_{Mc} = 1,8 for M10 to M24

SHEAR

Anchor size	M8	M10	M12	M16	M20	M24
V_{Rd}	7,7	13,2	17,7	32,7	39,3	63,9

γ_{Ms} = 1,43 for M8 to M16 and γ_{Ms} = 1,5 for M20 to M24

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

$$N_{rec} = \frac{N_{Rk}\,*}{\gamma_M \,.\, \gamma_F}$$

*Derived from test results (stud grade 10.9)

$$V_{rec} = \frac{V_{Rk}\,*}{\gamma_M \,.\, \gamma_F}$$

TENSILE

Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**
N_{rec}	8,6	10,1	14,0	19,9	33,9	47,1

γ_F = 1,4 ; γ_{Mc} = 1,5 for M8 and γ_{Mc} = 1,8 for M10 to M24

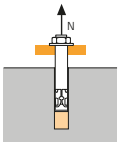
SHEAR

Anchor size	M8	M10	M12	M16	M20	M24
V_{rec}	5,5	9,4	12,6	23,4	28,1	45,6

γ_F = 1,4 ; γ_{Ms} = 1,43 for M8 to M16 and γ_{Ms} = 1,5 for M20 to M24

SPIT CC Method (values issued from ETA)

TENSILE in kN

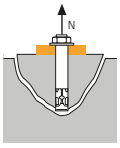


¬ Pull-out resistance for dry and wet concrete (1)

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

$N^{0}_{Rd,p}$						Design pull-out resistance
Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**
-40°C to +40°C	12,1	14,1	19,6	27,9	47,5	66,0

γ_{Mc} = 1,5 for M8 and γ_{Mc} = 1,8 for M10 to M24

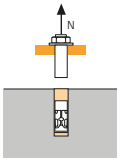


¬ Concrete cone resistance for dry and wet concrete (1)

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

$N^{0}_{Rd,p}$						Design cone resistance
Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**
-40°C to +120°C	24,0	23,9	32,3	39,1	62,1	85,2

γ_{Mc} = 1,5 for M8 and γ_{Mc} = 1,8 for M10 to M24



¬ Steel resistance

$N_{Rd,s}$						Steel design tensile resistance
Anchor size	M8	M10	M12	M16	M20	M24
Std. stud grade 5.8*	12,0	19,3	28,0	52,0	81,3	118,0
Std. stud grade 8.8*	19,3	30,7	44,7	84,0	130,7	188,0
Std. stud grade 10.9*	26,4	41,4	60,0	112,1	175,0	252,1
Stud stainless steel A4	13,7	21,7	31,6	58,8	91,7	132,1

Std. stud grade 5.8 and 8.8 : γ_{Ms} = 1,5

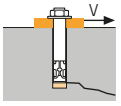
Std. stud grade 10.9 : γ_{Ms} = 1,4

Stud standard stainless steel A4 : γ_{Ms} = 1,87

(1) The concrete in the area of the anchorage is water statured. The anchor may be installed in flooded holes, but the figures above cannot be used, you must use the values given in the ETA for the category 2.

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

SHEAR in kN

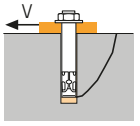


¬ Concrete edge resistance

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

$V^{0}_{Rd,c}$						Design concrete edge resistance at minimum edge distance (C_{min})
Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**80**	**80**	**90**	**110**	**125**	**170**
C_{min}	40	50	60	80	100	120
S_{min}	40	50	60	80	100	120
$V^{0}_{Rd,c}$	2,5	3,8	5,5	9,4	15,4	21,9

γ_{Mc} = 1,5

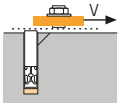


¬ Pryout failure

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

$V^{0}_{Rd,cp}$						Design pryout resistance
Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**
-40°C to +40°C	24,1	33,9	47,0	67,0	113,9	158,3

γ_{Mcp} = 1,5



¬ Steel resistance

$V_{Rd,s}$						Steel design shear resistance
Anchor size	M8	M10	M12	M16	M20	M24
Std. stud grade 5.8*	7,36	11,6	16,9	31,2	48,8	70,4
Std. stud grade 8.8*	11,68	18,6	27,0	50,4	78,4	112,8
Std. stud grade 10.9*	12,2	19,3	28,1	52,0	81,3	117,3
Stud stainless steel A4	7,3	11,9	17,3	32,7	51,3	73,1

Std. stud grade 5.8 and 8.8 : γ_{Ms} = 1,25

Std. stud grade 10.9 : γ_{Ms} = 1,5

Stud standard stainless steel A4 : γ_{Ms} = 1,56

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

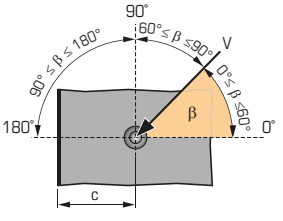
$$\beta_N + \beta_V \leq 1,2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b
C25/30	1,02
C30/37	1,04
C40/50	1,07
C50/60	1,09

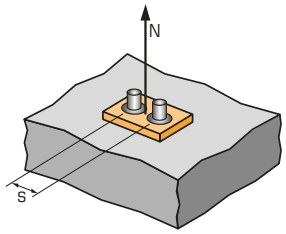
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

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



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

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

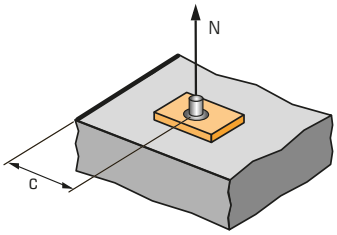
$s_{cr,N} = 2.h_{ef}$

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	0,58			
50	0,60	0,59		
60	0,63	0,61	0,59	
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 Non-cracked concrete	
Anchor size	M20	M24
100	0,60	
120	0,62	0,60
150	0,65	0,62
180	0,68	0,64
200	0,70	0,66
250	0,75	0,70
350	0,84	0,78
450	0,94	0,86
510	1,00	0,90
630		1,00
750		1,00

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



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

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

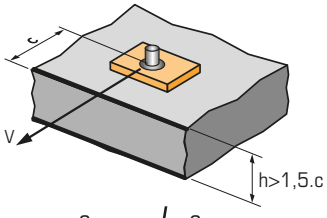
$c_{cr,N} = h_{ef}$

$\Psi_{c,N}$ 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	0,50			
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 $\Psi_{c,N}$ Non-cracked concrete	
Anchor size	M20	M24
100	0,54	
120	0,60	0,54
150	0,69	0,61
180	0,78	0,68
200	0,84	0,73
255	1,00	0,86
315		1,00

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

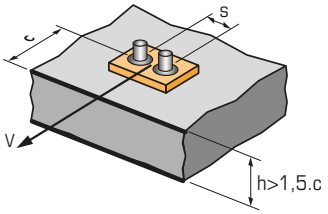


$$\Psi_{s-c,V} = \frac{c}{c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$

For single anchor fastening

	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

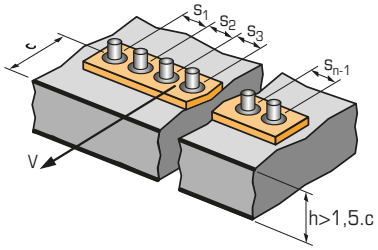
For 2 anchors fastening



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

	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	3,71	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



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