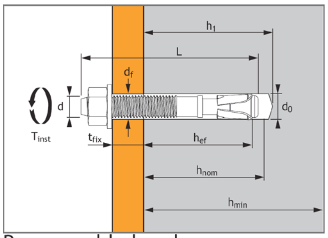
FIX 3 Stud Anchors - Galvanized Steel

ETA
European Technical Approval

ETA Option 7
n° 13/0005

Torque controlled expansion anchor, made of zinc coated steel for use in non cracked concrete



Pre-assembled anchor

Technical data

FIX3	Letter marking	Minimum anchor depth: Min. anchor depth (mm) $h_{ef,min}$	Depth before expans (mm) h_{nom}	Max thick of part to be fixed (mm) t_{fix}	Drilling Depth (mm) h_1	Min thick of base material (mm) h_{min}	Maximum anchor depth: Max. anchor depth (mm) $h_{ef,max}$	Depth before expans (mm) h_{nom}	Max thick of part to be fixed (mm) t_{fix}	Drilling Depth (mm) h_1	Min thick of base material (mm) h_{min}	Ø thread (mm) d	Ø drill bit (mm) d_0	Ø clear-ance (mm) d_f	Total anchor length (mm) L	Max. tighten torque (Nm) T_{inst}
M6x45/5*				5					-						45	
M6x55/15*		25,6	35	20	41	100	35	45	10	51	100	6	6	8	55	10
M6x85/45*				50					40						85	
M6x64 percée*				-					-						64	
M8x55/5	-			5					-						55	
M8x70/20-10	C			20					10						70	
M8x90/40-30	E			40					30						90	
M8x100/50-40	F	30	38	50	50	100	40	48	40	60	100	8	8	9	110	15
M8x115/65-55	G			65					55						115	
M8x130/80-70	H			80					70						130	
M8x160/110-100	J			110					100						160	
M10x65/5	-			5					-						65	
M10x75/15-5	C			15					5						75	
M10x85/25-15	D			25					15						85	
M10x95/36-26	E			36					26						95	
M10x110/50-40	F	40	50	50	60	100	50	60	40	70	100	10	10	12	110	30
M10x125/65-55	G			65					55						125	
M10x140/80-70	I			80					70						140	
M10x160/100-90	J			100					90						160	
M12x80/5	-			5					-						80	
M12x100/25-10	F			25					10						100	
M12x115/40-25	G			40					25						115	
M12x125/50-35	H			50					35						125	
M12x140/65-50	I	50	62	65	75	100	65	77	50	90	130	12	12	14	140	50
M12x160/85-70	J			85					70						160	
M12x180/105-90	L			105					90						180	
M12x220/145-130	O			145					130						220	
M12x290/215-200*	-			215					200						290	
M16x100/5	-			5					-						100	
M16x125/30-15	G			30					15						125	
M16x150/55-40	I			55					40						150	
M16x170/75-60	K	65	80	75	95	130	80	95	60	110	160	16	16	18	170	100
M16x185/90-75	L			90					75						185	
M16x235/140-125*	-			140					125						235	
M16x300/200*	-			200					178						300	
M20x125/10	-			10					-						125	
M20x165/50-25	J	75	93	50	110	150	100	118	25	135	200	20	20	22	165	160
M20x220/105-80	N			105					80						220	

* do not belongs to ETA

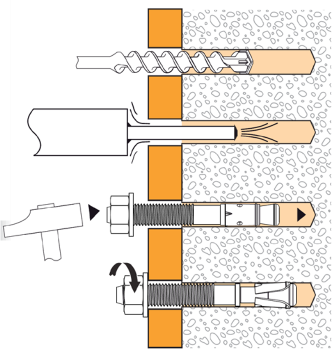
APPLICATION

- Steel and timber framework and beams
- Lift guide rails
- Industrial doors and gates
- Brickwork support angles
- Storage systems

MATERIAL

- Bolt M8-M20: Cold formed NFA 35-053 / Zinc electroplates (5 µm)
- Sleeve: Cold formed, NFA 35-231
- Washer: NF E25 513
- Hexagonal nut: Steel strength grade 6 or 8, ISO 898-2

INSTALLATION



Anchor mechanical properties

		M6	M8	M10	M12	M16	M20
Cross-section above cone							
f_{uk} (N/mm^2)	Min. tensile strength	700	750	750	750	700	600
f_{yk}(N/mm^2)	Yield strength	580	600	600	600	570	570
As (mm^2)	Stressed cross-section	-	23,8	34,7	56,1	103,9	172
Threaded part							
f_{uk} (N/mm^2)	Min. tensile strength	600	650	650	650	600	580
f_{yk}(N/mm^2)	Yield strength	480	520	520	520	480	480
As (mm^2)	Stressed cross-section	20,1	36,6	58	84,3	157	245
W_{el} (mm^3)	Elastic section modulus	12,71	31,23	62,3	109,17	277,47	540,9
$M^0_{Rk,s}$ (Nm)	Characteristic bending moment	9	24	49	85	200	376
M (Nm)	Recommended bending moment	3,7	9,8	20,0	34,7	81,6	153,5

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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.

Ultimate ($N_{Ru,m}$, $V_{Ru,m}$) / 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	M6	M8	M10	M12	M16	M20
Minimum anchorage depth						
h_{ef}	25	30	40	50	65	75
$N_{Ru,m}$	0,6	10,3	15,5	23,3	39,0	40,6
N_{Rk}	4,5	7,8	11,0	19,2	31,4	33,7
Maximum anchorage depth						
h_{ef}	35	40	50	65	80	100
$N_{Ru,m}$	9,4	15,6	22,0	33,8	47,1	69,0
N_{Rk}	7,0	14,0	18,0	28,3	42,0	56,1

SHEAR

Anchor size	M6	M8	M10	M12	M16	M20
$V_{Ru,m}$	6,8	14,3	22,6	32,8	56,5	85,2
V_{Rk}	2,9	9,9	13,7	29,4	36,5	62,2

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

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

TENSILE

Anchor size	M6	M8	M10	M12	M16	M20
Minimum anchorage depth						
h_{ef}	25	30	40	50	65	75
N_{Rd}	2,5	5,2	7,3	12,8	20,9	22,5
Maximum anchorage depth						
h_{ef}	35	40	50	65	80	100
N_{Rd}	3,8	9,3	12,0	18,9	28,0	37,4

$\gamma_{Mc} = 1,5$

SHEAR

Anchor size	M6	M8	M10	M12	M16	M20
V_{Rd}	2,3	7,9	11,0	23,5	29,2	41,5

$\gamma_{Ms} = 1,25$ (M6-M16)

$\gamma_{Ms} = 1,5$ (M20)

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

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

TENSILE

Anchor size	M6	M8	M10	M12	M16	M20
Minimum anchorage depth						
h_{ef}	25	30	40	50	65	75
N_{Rec}	1,7	3,7	5,2	9,1	15,0	16,0
Maximum anchorage depth						
h_{ef}	35	40	50	65	80	100
N_{Rec}	2,7	6,7	8,6	13,5	20,0	26,7

$\gamma_F = 1,4$; $\gamma_{Mc} = 1,5$

SHEAR

Anchor size	M6	M8	M10	M12	M16	M20
V_{Rec}	1,7	5,7	7,8	16,8	20,9	29,6

$\gamma_{Ms} = 1,25$

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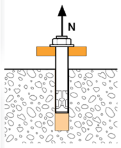
CC- Method (values issued from ETA)

TENSILE in kN

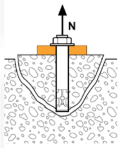


Pull-out resistance

$$N_{Rd,p} = N^{O}_{Rd,p} . f_b$$

$N^0_{Rd,p}$ Anchor size	M8	M10	M12	M16	M20
	Design pull-out resistance				
Minimum anchorage depth					
h_{ef}	30	40	50	65	75
$N^0_{Rd,p}$ (C20/25)	5,0	-	-	-	-
Maximum anchorage depth					
h_{ef}	40	50	65	80	100
$N^0_{Rd,p}$ (C20/25)	-	-	-	-	-

$\gamma_{Mc} = 1,5$

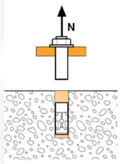


Concrete cone resistance

$$N_{Rd,c} = N^{O}_{Rd,c} . f_b . \Psi_s . \Psi_{c,N}$$

$N^0_{Rd,c}$ Anchor size	M8	M10	M12	M16	M20
	Design cone resistance				
Minimum anchorage depth					
h_{ef}	30	40	50	65	75
$N^0_{Rd,c}$ (C20/25)	5,5	8,5	11,9	17,6	21,8
Maximum anchorage depth					
h_{ef}	40	50	65	80	100
$N^0_{Rd,c}$ (C20/25)	8,5	11,9	17,6	24,0	33,6

$\gamma_{Mc} = 1,5$



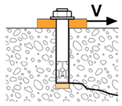
Steel resistance

$N_{Rd,s}$ Anchor size	M8	M10	M12	M16	M20
	Steel design tensile resistance				
$N_{Rd,s}$	11,9	17,3	28,1	48,5	73,7

$\gamma_{Ms} = 1,5$ (M8-M16)

$\gamma_{Ms} = 1,4$ (M20)

SHEAR in kN

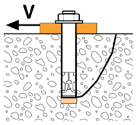


Concrete edge resistance

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

$V^0_{Rd,c}$ Anchor size	M8	M10	M12	M16	M20
	Design concrete edge resistance at minimum edge distance (C_{min})				
Minimum anchorage depth					
h_{ef}	30	40	50	65	75
C_{min}	50	65	100	100	115
S_{min}	40	50	100	100	100
$V^0_{Rd,c}$ (C20/25)	2,7	4,6	9,7	11,1	15,1
Maximum anchorage depth					
h_{ef}	40	50	65	80	100
C_{min}	55	65	70	105	120
S_{min}	45	60	70	90	100
$V^0_{Rd,c}$ (C20/25)	3,3	4,8	6,0	12,5	17,0

$\gamma_{Mc} = 1,5$

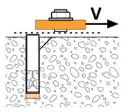


Pryout failure

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

$V^0_{Rd,cp}$ Anchor size	M8	M10	M12	M16	M20
	Design pryout resistance				
Minimum anchorage depth					
h_{ef}	30	40	50	65	75
$V^0_{Rd,cp}$ (C20/25)	5,5	8,5	11,9	35,2	43,6
Maximum anchorage depth					
h_{ef}	40	50	65	80	100
$V^0_{Rd,cp}$ (C20/25)	8,5	11,9	35,2	48,0	67,2

$\gamma_{Mcp} = 1,5$



Steel resistance

$V_{Rd,s}$ Anchor size	M8	M10	M12	M16	M20
	Steel design shear resistance				
$V_{Rd,s}$	8,0	11,0	21,9	29,2	47,4

$\gamma_{Ms} = 1,25$ (M8-M16)

$\gamma_{Ms} = 1,5$ (M20)

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

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

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

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

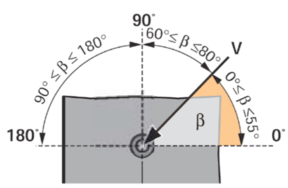
$$\beta_N + \beta_V \leq 1,2$$

f_B INFLUENCE OF CONCRETE

Concrete class	f_B	Concrete class	f_B
C25/30	1,1	C40/50	1,41
C30/37	1,22	C45/55	1,48
C35/45	1,34	C50/60	1,55

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

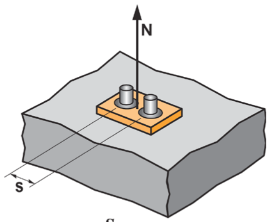
Angle β [°]	$f_{\beta,V}$
0 to 55	1
60	1,1
70	1,2
80	1,5
90 to 180	2



FIX 3 Stud Anchors - Galvanized Steel

CC- Method (values issued from ETA)

Ψ_s INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



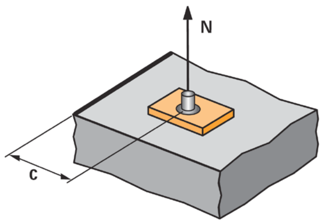
$$\Psi_S = 0,5 + \frac{s}{6.h_{ef}}$$

$S_{min} < S < S_{cr,N}$
$S_{cr,N} = 3.h_{ef}$
Ψ_S must be used for each spacing influenced the anchors group.

SPACING S	Reduction factor Ψ_s Minimum anchorage depth				
	M8	M10	M12	M16	M20
40	0,72				
50	0,78	0,71			
65	0,86	0,77			
90	1,00	0,88			
100		0,92	0,83	0,76	0,72
120		1,00	0,90	0,81	0,77
150			1,00	0,88	0,83
180				0,96	0,90
195				1,00	0,93
225					1,00

SPACING S	Reduction factor Ψ_s Maximum anchorage depth				
	M8	M10	M12	M16	M20
45	0,69				
60	0,75	0,70			
70	0,79	0,73	0,68		
90	0,88	0,80	0,73	0,69	
100	0,92	0,83	0,76	0,71	0,67
120	1,00	0,90	0,81	0,75	0,70
150		1,00	0,88	0,81	0,75
195			1,00	0,91	0,83
220				0,96	0,87
240				1,00	0,90
300					1,00

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



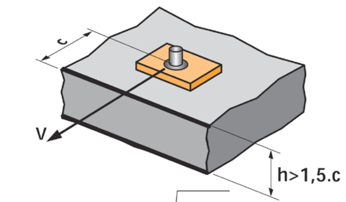
$$\Psi_{c,N} = 0,23 + 0,51.\frac{c}{h_{ef}}$$

$C_{min} < C < C_{cr,N}$
$C_{cr,N} = 1,5.h_{ef}$
$\Psi_{c,N}$ must be used for each distance influenced the anchors group.

EDGE C	Reduction factor $\Psi_{c,N}$ Minimum anchorage depth				
	M8	M10	M12	M16	M20
50	1,00				
65		1,00			
100			1,00		
100				1,00	
115					1,00

EDGE C	Reduction factor $\Psi_{c,N}$ Maximum anchorage depth				
	M8	M10	M12	M16	M20
55	0,93				
60	1,00				
65		0,89			
70		0,94	0,78		
75		1,00	0,82		
100			1,00		
105				0,90	
110				0,93	
120				1,00	0,84
130					0,89
150					1,00

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

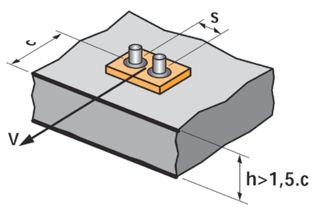


$$\Psi_{s-c,V} = \frac{c}{c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$

For single anchor fastening

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

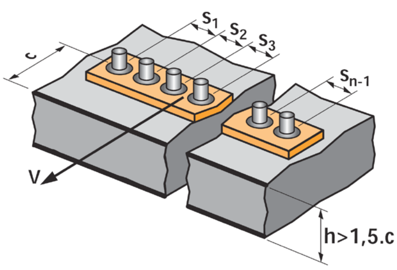


$$\Psi_{s-c,V} = \frac{3.c + s}{6.c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$

For 2 anchors fastening

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

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