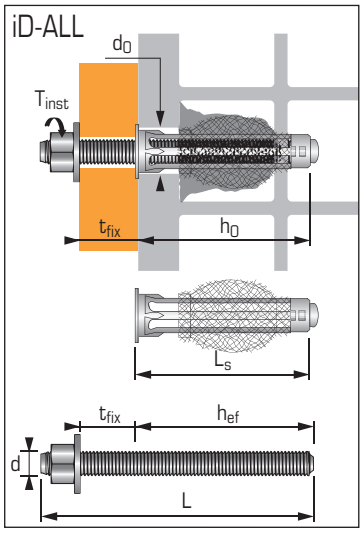
Methacrylate resin for fixing in hollow masonry

ETA CE
European Technical Assessment
ETAG 029- 13/0437

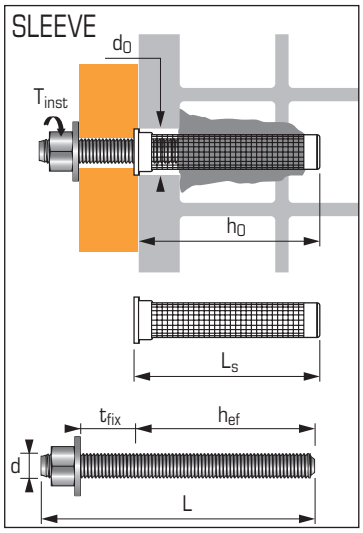


Technical data

Anchor size	Min. anchor depth (mm) h_{ef}	Drilling diameter (mm) d_0	Drilling depth (mm) h_0	Thread diameter (mm) d	Min. stud length (mm) L	External iD-ALL/Sleeve diameter (mm) d_{nom}	Total iD-ALL/Sleeve length (mm) L_s	Tighten torque (Nm) T_{inst}
iD-ALL + stud M8	65	16	70	8	76 + t_{fix}	16	70	3 [1]
iD-ALL + stud M10	65	16	70	10	78 + t_{fix}	16	70	3 [1]
Sleeve Ø20 + stud M12	85	20	90	12	98 + t_{fix}	20	85	3 [1]
Sleeve Ø15 + stud M8	130	15	135	8	138 + t_{fix}	15	130	3 [1]
Sleeve Ø15 + stud M10	130	15	135	10	140 + t_{fix}	15	130	3 [1]

MULTI-MAX Vinylester resin dual component cartridge 410 ml	Code : 060047
MULTI-MAX Vinylester resin dual component cartridge 280 ml	Code : 060040
For Sleeves and studs code numbers see catalogue	

[1] 2 Nm Clay masonry OPTIBRIC PV 3+ and in hollow concrete block.



Setting time

Temperature	Max. time for installation	Curing time
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

2/2

APPLICATION

- Signs
- Scaffolding
- Electrical switchboards
- Radiators
- Air conditioning ducts
- Rail guard returns
- Blinds
- Climbing walls
- Metal scale
- Hand rails
- Pole and ducts
- Demountable partitions
- Kitchen furniture
- Decorations

Recommended loads (N_{rec}, V_{rec}) in kN

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

TENSILE

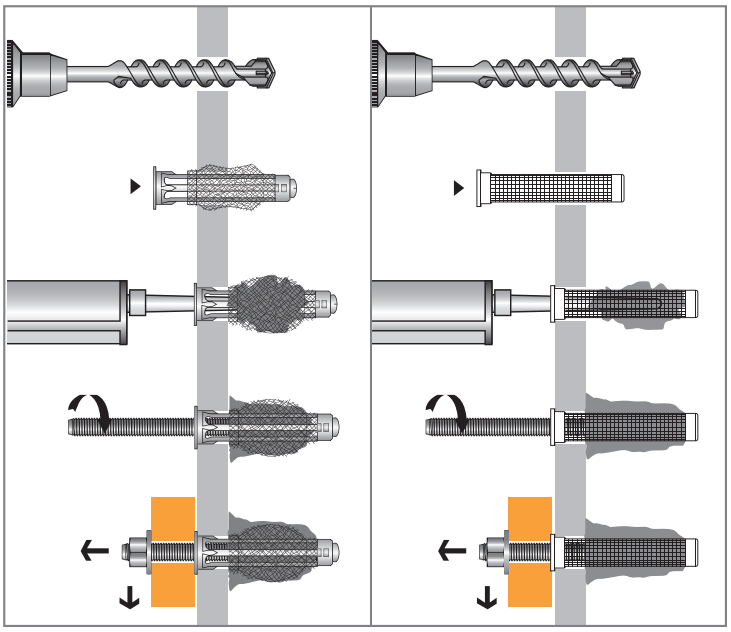
Anchor size	iD-ALL		Sleeve		
			Ø20X85	Ø15X130	
	M8	M10	M12	M8	M10
Holow concrete blocks B 40 ($f_b \geq 6.0$ N/mm²)					
N_{rec}	0,57		0,43	0,43	
Hollow clay bricks OPTIBRIC PV 3+ ($f_b \geq 9.0$ N/mm²)					
N_{rec}	0,43		0,71	0,43	
Clay masonries POROTHE RM GF R20 Th+ ($f_b \geq 9.0$ N/mm²)					
N_{rec}	0,25		0,71	0,34	
Clay masonries POROTHE RM GF R37 Th+ ($f_b \geq 9.0$ N/mm²)					
N_{rec}	0,34		0,25	0,57	
Calcium silicate masonries KSL-R (P) 240 ($f_b \geq 9.0$ N/mm²)					
N_{rec}	0,43		1,0	0,86	

SHEAR

	iD-ALL		Sleeve		
			Ø20X85	Ø15X130	
	M8	M10	M12	M8	M10
V_{rec}	0,71		0,57	0,86	
V_{rec}	0.43		1,00	0,34	
V_{rec}	1,14		0,86	1,00	
V_{rec}	0,25		1,14	0,43	
V_{rec}	2,57	3,14	2,85	2,57	3,43

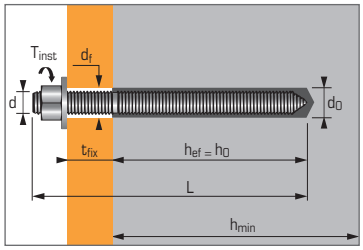
$\gamma_F = 1,4$; $\gamma_M = 2,5$

Installation



Methacrylate chemical resin for use in non-cracked concrete

ETA Option 7- 13/0435



APPLICATION

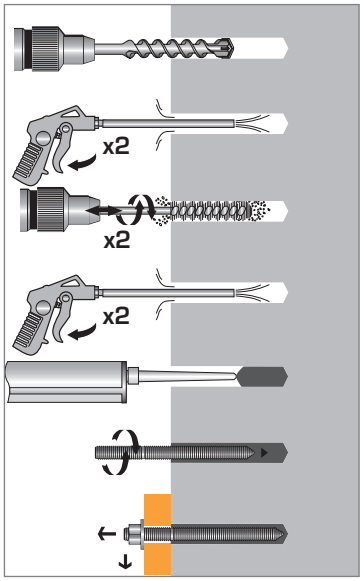
- Fixing steel framed structures
- Fixing machinery (resistant to vibration)
- Fixing of storage silos, refinery pipework supports
- Fixing motorway signs
- Fixing safety barriers

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

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

*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
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

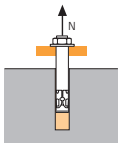
SHEAR

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

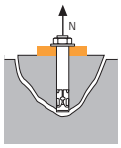


Pull-out resistance for dry and wet concrete (1)

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

$N^{0}_{Rd,p}$	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

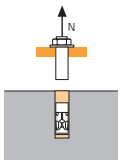


Concrete cone resistance for dry and wet concrete (1)

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

$N^{0}_{Rd,p}$	Design cone resistance					
Anchor size	M8	M10	M12	M16	M20	M24
h_{ef}	**80**	**90**	**110**	**125**	**170**	**210**
-40°C to +40°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

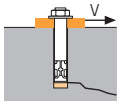
Std. stud grade 10.9 : γ_{Ms} = 1,4

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

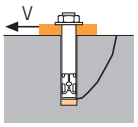


Concrete edge resistance

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

$V^{0}_{Rd,c}$	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

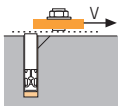


Pryout failure

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

$V^{0}_{Rd,cp}$	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

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

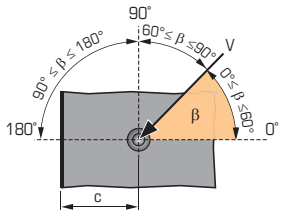
$$\beta_N + \beta_V \leq 1,2$$

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

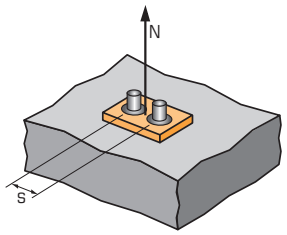
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

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



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

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

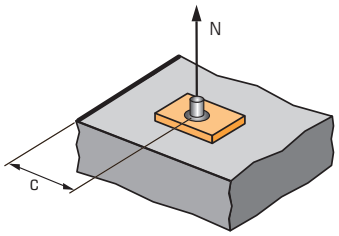
$s_{cr,N} = 2.h_{ef}$

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



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

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

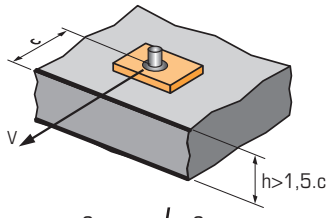
$c_{cr,N} = h_{ef}$

$\Psi_{c,N}$ 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

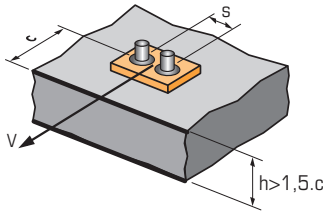
$\Psi_{s\text{-}c,V}$ INFLUENCE OF SPACING AND EDGE DISTANCE FOR CONCRETE EDGE RESISTANCE IN SHEAR LOAD



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

For single anchor fastening

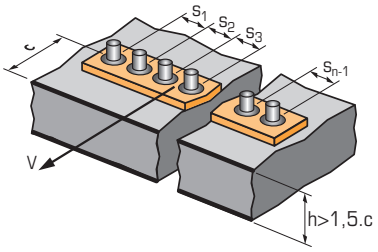
	Reduction factor $\Psi_{s\text{-}c,V}$ Non-cracked concrete											
$\frac{C}{C_{min}}$	1,0	1,2	1,4	1,6	1,8	2,0	2,2	2,4	2,6	2,8	3,0	3,2
$\Psi_{s\text{-}c,V}$	1,00	1,31	1,66	2,02	2,41	2,83	3,26	3,72	4,19	4,69	5,20	5,72



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

For 2 anchors fastening

	Reduction factor $\Psi_{s\text{-}c,V}$ 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

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

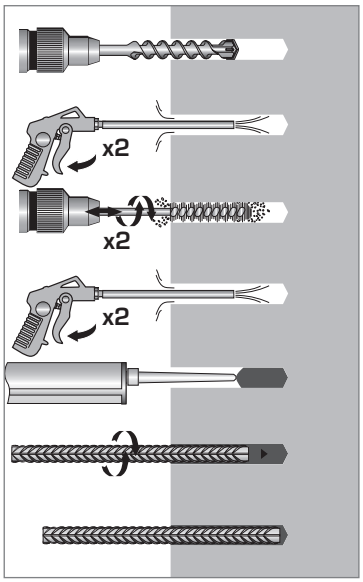
Post-installed rebar

ETA TR 023- 13/0436

MULTI-MAX

- Methacrylate resin
- Fast cure time
- Storage time 18 mois
- Usable in wet environments
- Styrene free
- Volatile Organic Compounds free (VOCs)
- Cartridge compatible with standard injection gun

INSTALLATION*



***Premium cleaning :**
- 2 blowing with compressed air
- 2 brushing with brushed fitted on a drilling machine
- 2 blowing with compressed air

Mechanical characteristics of rebars

Nominal steel rebar Ø		Ø8	Ø10	Ø12	Ø14	Ø16	Ø20
Sections (cm^2)		0,503	0,785	1,13	1,54	2,01	3,14
Min. resistances to failure (kN)	Fe E400	21,13	32,97	47,46	64,68	84,42	131,88
	Fe E500	25,90	40,43	58,20	79,31	103,52	161,71
Ultimate limit load N_{Rd} (kN)	Fe E500	21,85	34,15	49,17	66,93	87,42	136,59

The mechanical characteristics of the high adhesion rebars are defined in the NFA 35-016 and NFA 35-017 standards.

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

Sizing rules for steel reinforcement fixings for concrete according to eurocode 2 regulations and ETA 13/0436

The basic anchorage length $L_{b,rqd}$ (mm) for the ultimate limit load for rebar F_{Rd} (N) is given by following equation:

$$L_{b,rqd} = \frac{F_{Rd}}{\Pi \cdot Ø \cdot \eta_1 \cdot \eta_2 \cdot f_{bd}}$$

The design anchorage length L_{bd} (mm) is determined as follow:

$L_{bd} = L_{b,rqd} \cdot \alpha_2 \cdot \alpha_5$

F_{Rd} : Design ultimate load (N)
f_{bd} : Design value of the bond strength in N/mm^2
Ø : Rebar diameter (mm)
η : depends on bond conditions - $\eta_1 = 1$ ("good bond" conditions). See § 8.4.2 (EN 1992-1-1)
η_2 : depends on rebar diameter - $\eta_2 = 1$ for Ørebar ≤ 32 mm

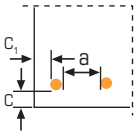
Design value of the bond strength f_{bd} according to EN 1992-1-1

Ø rebar	C12/15	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Ø8	1.6	2.0	2.3	2.7	3.0	3.4	3.4	3.7	3.7
Ø10	1.6	2.0	2.3	2.7	3.0	3.4	3.4	3.4	3.4
Ø12	1.6	2.0	2.3	2.7	3.0	3.0	3.0	3.0	3.4
Ø14	1.6	2.0	2.3	2.7	3.0	3.0	3.0	3.0	3.0
Ø16	1.6	2.0	2.3	2.7	2.7	2.7	2.7	2.7	3.0
Ø20	1.6	2.0	2.3	2.3	2.3	2.3	2.3	2.3	2.7

with α_2 : **Influence of concrete minimum cover**

$\alpha_2 = 1 - 0{,}15\,(Cd - Ø_{rebar}) / Ø_{rebar} \geq 0{,}7$

$Cd = \min\left(C ; C_1 ; \frac{a}{2}\right)$



with α_5 : **Influence of the confinement by transverse pressure**

The factor α_5 take into account of the effect of the pressure transverse to the plane of splitting along the design length.

$\alpha_5 = 1 - 0{,}04 \cdot p \geq 0{,}7$
where p is the transverse pressure at the ultimate limit state along L_{bd} in MPa.

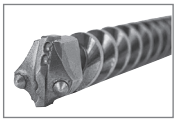
p (MPa)	α_5
3	0,88
5	0,8
7	0,72

Limit of this formula

The max. anchor depth will be limited to 900 mm with pneumatic injection tool.

Eurocode 2 table for straight rebar anchoring

CONCRETE C25/30 - HAMMER DRILLING



Rebar Ø (mm)	Drilling Ø d_0 (mm)	Length of anchor L_{bd} (mm)	Ultimate limit load (daN) without influence of center distance and/or edge [1] ($\alpha 2 = 0,7$)	Ultimate limit load (daN) with influence of center distance and/or edge [2] ($\alpha 2 = 1$)	Number of sealings per SPIT MULTI-MAX cartridge [3]	
					280 ml	410 ml
8	10	170	1648	1154	48,5	71,1
		190	1842	1289	43,4	63,6
		225	2185	1530	36,6	53,6
		322	-	2185	25,6	37,5
10	12	213	2577	1804	31,7	46,5
		240	2908	2036	28,1	41,2
		282	3415	2391	24,0	35,1
		403	-	3415	16,8	24,6
12	15	255	3711	2597	14,4	21,0
		290	4217	2952	12,6	18,5
		338	4917	3442	10,8	15,9
		483	-	4917	7,6	11,1
14	18	298	5051	3536	7,8	11,4
		340	5768	4038	6,8	10,0
		395	6693	4685	5,9	8,6
		564	-	6693	4,1	6,0
16	20	340	6597	4618	6,1	8,9
		380	7367	5157	5,4	7,9
		451	8742	6119	4,6	6,7
		644	-	8742	3,2	4,7
20	25	425	8781	6147	3,1	4,5
		490	10116	7081	2,7	3,9
		662	13659	9561	2,0	2,9
		900	-	13006	1,5	2,1

[1] Absence of edge distances greater than or equal to 7.Ø

[2] Presence of edge distances and/or centre distances less than 7.Ø

[3] The number of fixings per cartridge is calculated taking into account an increasing by 20% the real volume of sealing.

$1,2 \times (d_0^2 - Ø_{rebar}^2) \times \Pi \times L_{bd}/4$