EAC80 VINYLESTER STYRENE FREE RESIN WITH VA RODS

PRODUCT FEATURES

- Medium to high load applications.
- Excellent for chemical resistance fixings.
- For use in dry, wet & flooded holes without loss of performance.
- High durability; tested based on a 50 years working life of anchor according to ETA.
- ETA Approval for use in non-cracked concrete.

RESIN SPECIFICATIONS

- Vinylester Styrene Free Resin - grey after mixing.
- Specific weight: 1.7 g/cm^3.
- Compressive Strength (BS 6319): 80 N/mm^2.

SHELF LIFE

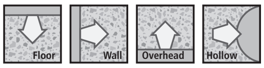
- Shelf life is 18 months with the cartridges stored in their original packing, the correct way up and in cool dry conditions (+5ºC to +25ºC) out of direct sunlight.

SUBSTRATES

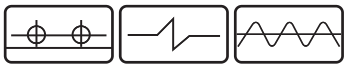
- RC concrete C20/25 to C50/60 at maximum according to EN 206-1:2000-12.
- Solid stone, brickworks & other solid or hollow masonry.

CONC | STONE | BRICK | HOLLOW

HOLE ORIENTATION



LOADING ZONES



APPROVALS / CERTIFICATIONS

- ETA-17/0409 according to ETAG 001 Part 1 & 5 Option 7.
- CE Certified No. 1020-CPR-090-038601.
- VOC A Rating (Volatile Organic Compound)
- WRAS No. 1605536 according to BS6920-1:2014.

VA RODS AVAILABILITY

Z ZINC | G | A2 INOX | A4 INOX

BASIC LOADING DATA

- For static and quasi-static loadings.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Loading applicable to dry, wet and flooded hole.
- For non-cracked concrete only.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm^2).
- Loading data conformed to ETA-17/0409.

CHARACTERISTIC RESISTANCE [F_{Rk}] — **STEEL CLASS 5.8**

Anchor Size		M8	M10	M12	M16	M20	M24
Tensile Load, N_{Rk}	[kN]	***18.0***	22.6	37.3	59.7	90.8	134.6
Shear Load, V_{Rk}	[kN]	9.0	15.0	21.0	39.0	61.0	88.0

DESIGN RESISTANCE [F_{Rd}]

Anchor Size		M8	M10	M12	M16	M20	M24
Tensile Load, N_{Rd}	[kN]	11.2	12.6	20.7	33.2	50.4	74.8
Shear Load, V_{Rd}	[kN]	7.2	12.0	16.8	31.2	48.8	70.4

RECOMMENDED LOAD [F_{Rec}]

Anchor Size		M8	M10	M12	M16	M20	M24
Tensile Load, N_{Rec}	[kN]	8.0	9.0	14.8	23.7	36.0	53.4
Shear Load, V_{Rec}	[kN]	5.1	8.6	12.0	22.3	34.9	50.3

** Bold Italic numbers represent steel failure.*

CHARACTERISTIC RESISTANCE [F_{Rk}] — **HIGH TENSILE STEEL CLASS 8.8**

Anchor Size		M8	M10	M12	M16	M20	M24
Tensile Load, N_{Rk}	[kN]	20.1	22.6	37.3	59.7	90.8	134.6
Shear Load, V_{Rk}	[kN]	15.0	23.0	34.0	63.0	98.0	141.0

DESIGN RESISTANCE [F_{Rd}]

Anchor Size		M8	M10	M12	M16	M20	M24
Tensile Load, N_{Rd}	[kN]	11.2	12.6	20.7	33.2	50.4	74.8
Shear Load, V_{Rd}	[kN]	12.0	18.4	27.2	50.4	78.4	112.8

RECOMMENDED LOAD [F_{Rec}]

Anchor Size		M8	M10	M12	M16	M20	M24
Tensile Load, N_{Rec}	[kN]	8.0	9.0	14.8	23.7	36.0	53.4
Shear Load, V_{Rec}	[kN]	8.6	13.1	19.4	36.0	56.0	80.6

** Bold Italic numbers represent steel failure.*

CHARACTERISTIC RESISTANCE [F_{Rk}]						STAINLESS STEEL CLASS A2/A4	
Anchor Size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Tensile Load, N_{Rk}	[kN]	20.1	22.6	37.3	59.7	90.8	134.6
Shear Load, V_{Rk}	[kN]	13.0	20.0	30.0	55.0	86.0	124.0

DESIGN RESISTANCE [F_{Rd}]							
Anchor Size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Tensile Load, N_{Rd}	[kN]	11.2	12.6	20.7	33.2	50.4	74.8
Shear Load, V_{Rd}	[kN]	8.3	12.8	19.2	35.3	55.1	79.5

RECOMMENDED LOAD [F_{Rec}]							
Anchor Size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Tensile Load, N_{Rec}	[kN]	8.0	9.0	14.8	23.7	36.0	53.4
Shear Load, V_{Rec}	[kN]	6.0	9.2	13.7	25.2	39.4	56.8

** Bold Italic numbers represent steel failure.*

SERVICE TEMPERATURE RANGE

The Statheros EAC80 Vinylester Styrene Free Resin performance based on the tabulated temperature range as given below. A gradual temperature increase in base material may lead to a reduction of design bond stress.

TEMPERATURE RANGE	BASE MATERIAL TEMPERATURE	MAXIMUM LONG TERM BASE MATERIAL TEMPERATURE	MAXIMUM SHORT TERM BASE MATERIAL TEMPERATURE
Temperature Range	-40 °C to + 80 °C	+ 50 °C	+80 °C

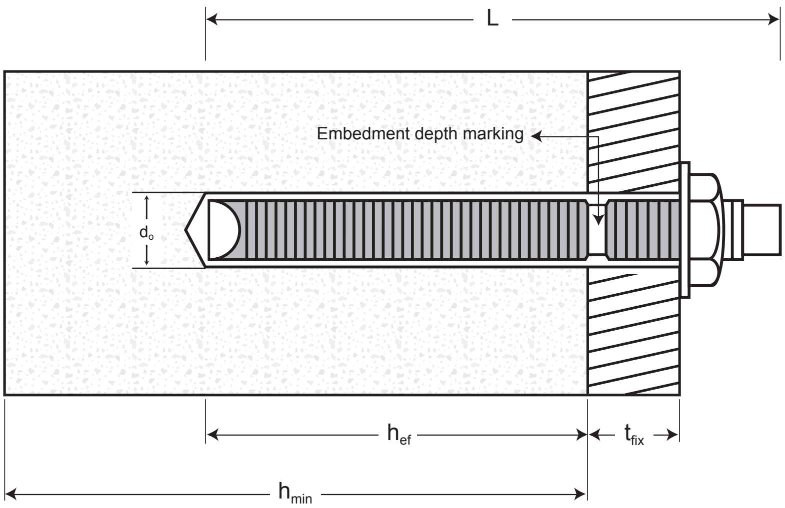
Maximum Short Term Base Material Temperature
Short term temperature refers to those elevated base material temperature occurred over brief moment such as diurnal cycling intervals.

Maximum Long Term Base Material Temperature
Long term temperature refers to those elevated base material temperature occurred over a significant long period of time.

SETTING DETAILS

ANCHOR SIZE		M8	M10	M12	M16	M20	M24
Standard Anchor Length, L	[mm]	110	130	160	190	260	300
Nominal Drill Hole Diameter, d_0	[mm]	10	12	14	18	24	28
Fixture Hole Diameter, d_{fix}	[mm]	9	12	14	18	22	26
Maximum Fixture Thickness, t_{fix}	[mm]	15	20	30	40	50	55
Recommended Torque, T_{inst}	[Nm]	10	20	40	80	150	200
Minimum Anchorage Depth, $h_{ef,min} = 8d$							
Minimum Anchorage Depth, $h_{ef,min}$	[mm]	64	80	96	128	160	192
Minimum Spacing, s_{min}	[mm]	35	40	50	65	80	96
Minimum Edge Distance, c_{min}	[mm]	35	40	50	65	80	96
Minimum Concrete Thickness, h_{min}	[mm]	$h_{ef,min} + 30mm \geq 100mm$				$h_{ef,min} + 2d_o$	
Maximum Anchorage Depth, $h_{ef,max} = 12d$							
Maximum Anchorage Depth, $h_{ef,max}$	[mm]	96	120	144	192	240	288
Minimum Spacing, s_{min}	[mm]	50	60	70	95	120	145
Minimum Edge Distance, c_{min}	[mm]	50	60	70	95	120	145
Minimum Concrete Thickness, h_{min}	[mm]	$h_{ef,max} + 30mm \geq 100mm$				$h_{ef,max} + 2d_o$	
Standard Anchorage Depth, $h_{ef,std}$							
Standard Anchorage Depth, $h_{ef,std}$	[mm]	80	90	110	125	170	210
Minimum Spacing, s_{min}	[mm]	40	45	55	65	85	105
Minimum Edge Distance, c_{min}	[mm]	40	45	55	65	85	105
Minimum Concrete Thickness, h_{min}	[mm]	$h_{ef,std} + 30mm \geq 100mm$				$h_{ef,std} + 2d_o$	

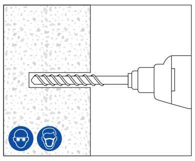
SETTING DIAGRAM



INSTALLATION PROCEDURES

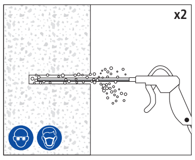
Before commencing installation ensure the operative is equipped with appropriate personal protection equipment, SDS Hammer Drill, Air Blower, Hole Cleaning Brush, good quality Dispensing Tool – either manual or power operated, Chemical Cartridge with mixing nozzle and extension tube, if needed.

1. Using the SDS Hammer Drill in rotary hammer mode for drilling, with a carbide tipped drill bit of the appropriate size, drill the hole to the specified hole diameter and depth.



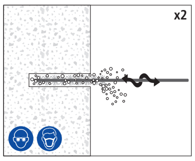
2. Insert the Air Lance to the bottom of the hole and depress the trigger for 2 seconds. The compressed air must be clean – free from water and oil – and at a minimum pressure of 6bar.

   Perform the blowing operation twice.

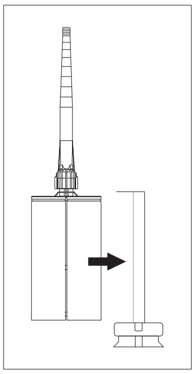


3. Select the correct size Hole Cleaning Brush. Ensure that the brush is in good condition and the correct diameter. Insert the brush to the bottom of the hole, use a brush extension if needed to reach the bottom of the hole and withdraw with a twisting motion. There should be positive interaction between the steel bristles of the brush and the sides of the drilled hole.

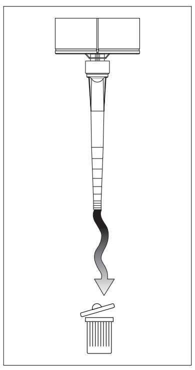
   Perform the brushing operation twice.



4. Repeat 2
5. Repeat 3
6. Repeat 2
7. Select the appropriate static mixer nozzle, check that the mixing elements are present and correct ***(do not modify the mixer).*** Attach mixer nozzle to the cartridge. Check the Dispensing Tool is in good working order. Place the cartridge into the dispensing tool.

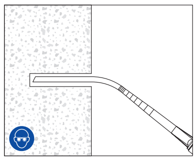


8. Extrude some resin to waste until an even-colored mixture is extruded. The cartridge is now ready to use.

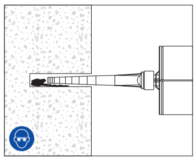


9. Attach an extension tube with resin stopper (if required) to the end of the mixing nozzle with a push fit.

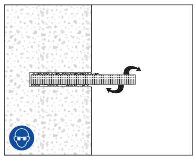
   (The extension tubes may be pushed into the resin stoppers and are held in place with a coarse internal thread).



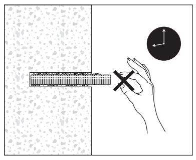
10. Insert the mixing nozzle to the bottom of the hole. Extrude the resin and slowly withdraw the nozzle from the hole. **Ensure no air voids are created** as the nozzle is withdrawn. Inject resin until the hole is approximately ½ to ¾ full and remove the nozzle from the hole.



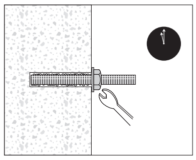
11. Select the steel anchor element and ensure it is free from oil or other contaminants, and mark with the required embedment depth. Insert the steel element into the hole using a back and forth twisting motion to ensure complete cover, until it reaches the bottom of the hole. Excess resin will be expelled from the hole evenly around the steel element and there shall be no gaps between the anchor element and the wall of the drilled hole.



12. Clean any excess resin from around the mouth of the hole.
13. Do not disturb the anchor until at least the minimum curing time has elapsed. Refer to the Gel and Curing Timetable to determine the appropriate cure time.



14. Position the fixture and tighten the anchor to the appropriate installation torque.



Do not over-torque the anchor as this could adversely affect its performance.

GEL AND CURING TIME[1]

BASE MATERIAL TEMPERATURE $T_{base\ material}$ (°C)	GEL TIME (WORKING TIME) t_{gel} (mins)	CURING TIME t_{cure} (mins)
min. +5	18	145
$+5 \leq T_{base\ material} < +10$	10	145
$+10 \leq T_{base\ material} < +20$	6	85
$+20 \leq T_{base\ material} < +25$	5	50
$+25 \leq T_{base\ material} < +30$	4	40
+30 & above	4	35

[1] The curing time after are for dry base material only. In wet base material, the curing time must be doubled.

MATERIAL SPECIFICATIONS

DESIGNATION	MATERIAL
VA Rods - Class 5.8 & 8.8 M8 - M30	Strength class 5.8, 8.8 to EN ISO 898-1 Steel, zinc plated ≥ 5µm to EN ISO 4042 Steel, hot dipped galvanised ≥ 40µm to EN ISO 10684
Washer ISO 7089	Steel, zinc plated to EN ISO 4042 Steel, hot dipped galvanised to EN ISO 10684
Hexagon Nut EN ISO 4032	Strength class 5.8, 8.8 to EN ISO 898-2 Steel galvanised ≥ 5µm to EN ISO 4042 Hot dipped galvanised ≥ 40µm to EN ISO 10684
VAS Rods - Class A2 & A4 M8 - M30	Strength class A2-70 & A4-70 to EN ISO 3506-1 Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 to EN 10088
Washer ISO 7089	Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 EN 10088
Hexagon Nut EN ISO 4032	Strength class A2-70 & A4-70 to EN ISO 3506-2 Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 to EN 10088

MECHANICAL PROPERTIES

ANCHOR SIZE		M8	M10	M12	M16	M20	M24
Cross Sectional Area, A_s	[mm²]	36.6	58.0	84.3	157.0	245.0	353.0
Nominal Tensile Strength, f_{uk}	[N/mm²]						
~ Carbon Steel: Class 5.8		500	500	500	500	500	500
~ High Tensile Steel: Class 8.8		800	800	800	800	800	800
~ Stainless Steel: Class A2/A4		700	700	700	700	700	700
Nominal Yield Strength, f_{yk}	[N/mm²]						
~ Carbon Steel: Class 5.8		400	400	400	400	400	400
~ High Tensile Steel: Class 8.8		640	640	640	640	640	640
~ Stainless Steel: Class A2/A4		450	450	450	450	450	450
Elastic Moment Of Resistance, W_{el}	[mm³]	31.2	62.3	109.2	277.5	540.9	935.5
Design Bending Moment, $M_{Rd,s}$	[Nm]						
~ Carbon Steel: Class 5.8		15.2	29.6	52.8	132.8	260.0	448.8
~ High Tensile Steel: Class 8.8		24.0	48.0	84.0	212.8	415.2	718.4
~ Stainless Steel: Class A2/A4		16.7	33.3	59.0	149.4	291.0	503.8

The design bending moment is derived from $M_{Rd,s} = M_{Rk,s} / \gamma_{Ms,N}$ where the partial safety factor is 1.25 for carbon steel 5.8 and high tensile steel 8.8; 1.56 for stainless steel A2/A4. The recommended bending moment is derived from $M_{Rec,s} = M_{Rd,s} / \gamma_F$ where the partial safety factor is 1.4.

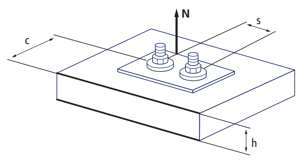
TENSION LOAD [N_{Rd}]

Design Tensile Resistance, N_{Rd}: lower value of [$N_{Rd,s}$; $N_{Rd,p}$; $N_{Rd,c}$]

Design Steel Tensile Resistance: $N_{Rd,s}$

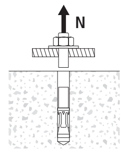
Design Pull-Out Resistance: $N_{Rd,p} = N^0_{Rd,p} \cdot \Psi_{h,N} \cdot \Psi_{\beta,N}$

Design Concrete Cone Resistance: $N_{Rd,c} = N^0_{Rd,c} \cdot \Psi_{h,N} \cdot \Psi_{\beta,N} \cdot \Psi_{s,N} \cdot \Psi_{c,N}$



STEEL TENSILE RESISTANCE [$N_{Rd,s}$]

- For static and quasi-static loadings.
- Only a single anchor is considered.
- For non-cracked concrete only.
- Data valid only for specified steel grade.
- Loading data conformed to ETA-17/0409.

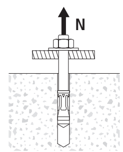


ANCHOR SIZE		M8	M10	M12	M16	M20	M24
Carbon Steel: Class 5.8							
$N_{Rd,s}$	[kN]	12.0	19.3	28.0	52.7	82.0	118.0
High Tensile Steel: Class 8.8							
$N_{Rd,s}$	[kN]	19.3	30.7	44.7	84.0	130.7	188.0
Stainless Steel: Class A2/A4							
$N_{Rd,s}$	[kN]	13.7	21.6	31.1	57.9	90.5	130.0

The design steel tensile resistance is derived from $N_{Rd,s} = N_{Rk,s} / \gamma_{Ms,N}$ where the partial safety factor is 1.5 for carbon steel 5.8 and high tensile steel 8.8; 1.9 for stainless steel A2/A4. The recommended load is derived from $N_{Rec,s} = N_{Rd,s} / \gamma_F$ where the partial safety factor is 1.4.

PULL-OUT RESISTANCE [$N_{Rd,p}$]

- For static and quasi-static loadings.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Loading applicable to dry, wet and flooded hole.
- For non-cracked concrete only.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).
- Loading data conformed to ETA-17/0409.

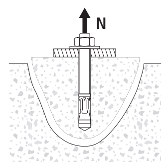


ANCHOR SIZE		M8	M10	M12	M16	M20	M24
$h_{ef,std}$	[mm]	80	90	110	125	170	210
$N^0_{Rd,p}$	[kN]	11.2	12.6	20.7	33.2	50.4	74.8

The design pull-out resistance is derived from $N^0_{Rd,p} = N^0_{Rk,p} / \gamma_{Mc,N}$ where the partial safety factor is 1.8. The recommended load is derived from $N^0_{Rec,p} = N^0_{Rd,p} / \gamma_F$ where the partial safety factor is 1.4.

CONCRETE CONE RESISTANCE [$N_{Rd,c}$]

- For static and quasi-static loadings.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Loading applicable to dry, wet and flooded hole.
- For non-cracked concrete only.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).
- Loading data conformed to ETA-17/0409.



ANCHOR SIZE		M8	M10	M12	M16	M20	M24
$h_{ef,std}$	[mm]	80	90	110	125	170	210
$N^0_{Rd,c}$	[kN]	24.1	28.7	38.8	47.1	74.6	102.5

The design concrete cone resistance is derived from $N^0_{Rd,c} = N^0_{Rk,c} / \gamma_{Mc,N}$ where the partial safety factor is 1.5. The recommended load is derived from $N^0_{Rec,c} = N^0_{Rd,c} / \gamma_F$ where the partial safety factor is 1.4.

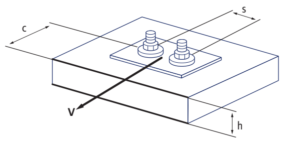
SHEAR LOAD [V_{Rd}]

Design Shear Resistance, V_{Rd}: lower value of [$V_{Rd,s}$; $V_{Rd,c}$; $V_{Rd,cp}$]

Design Steel Shear Resistance: $V_{Rd,s}$

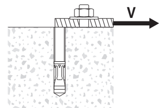
Design Concrete Edge Shear Resistance: $V_{Rd,c} = V^0_{Rd,c} \cdot \Psi_{\beta,V} \cdot \Psi_{\alpha,V} \cdot \Psi_{sc,V}$

Design Concrete Pry-Out Resistance: $V_{Rd,cp} = V^0_{Rd,cp} \cdot \Psi_{\beta,V} \cdot \Psi_{s,N} \cdot \Psi_{c,N}$



STEEL SHEAR RESISTANCE [$V_{Rd,s}$]

- For static and quasi-static loadings.
- Only a single anchor is considered.
- For non-cracked concrete only.
- Data valid only for specified steel grade.
- Loading data conformed to ETA-17/0409.

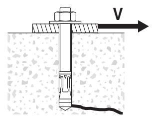


ANCHOR SIZE		M8	M10	M12	M16	M20	M24
Carbon Steel: Class 5.8							
$V_{Rd,s}$	[kN]	7.2	12.0	16.8	31.2	48.8	70.4
High Tensile Steel: Class 8.8							
$V_{Rd,s}$	[kN]	12.0	18.4	27.2	50.4	78.4	112.8
Stainless Steel: Class A2/A4							
$V_{Rd,s}$	[kN]	8.3	12.8	19.2	35.3	55.1	79.5

The design steel shear resistance is derived from $V_{Rd,s} = V_{Rk,s} / \gamma_{Ms,v}$ where the partial safety factor is 1.25 for carbon steel 5.8 and high tensile steel 8.8; 1.56 for stainless steel A2/A4. The recommended load is derived from $V_{Rec,s} = V_{Rd,s} / \gamma_F$ where the partial safety factor is 1.4.

CONCRETE EDGE SHEAR RESISTANCE [$V_{Rd,c}$]

- For static and quasi-static loadings.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Loading applicable to dry, wet and flooded hole.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).
- For non-cracked concrete only.
- Loading data conformed to ETA-17/0409.

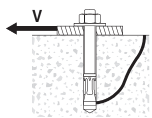


ANCHOR SIZE		M8	M10	M12	M16	M20	M24
$h_{ef,std}$	[mm]	80	90	110	125	170	210
c_{min}	[mm]	40	45	55	65	85	105
$V^0_{Rd,c}$	[kN]	3.6	4.7	6.9	10.1	19.0	25.8

The design concrete edge shear resistance is derived from $V^0_{Rd,c} = V^0_{Rk,c} / \gamma_{Mc,V}$ where the partial safety factor is 1.5. The recommended load is derived from $V^0_{Rec,c} = V^0_{Rd,c} / \gamma_F$ where the partial safety factor is 1.4.

CONCRETE PRY-OUT RESISTANCE [$V_{Rd,cp}$]

- For static and quasi-static loadings.
- Only a single anchor is considered.
- No anchor spacing and edge distance influences.
- Loading applicable to dry, wet and flooded hole.
- For non-cracked concrete only.
- Concrete compressive strength C20/25 ($f_{ck,cube}$ = 25 N/mm²).
- Loading data conformed to ETA-17/0409.



ANCHOR SIZE		M8	M10	M12	M16	M20	M24
$h_{ef,std}$	[mm]	80	90	110	125	170	210
$V^0_{Rd,cp}$	[kN]	48.2	57.5	77.7	94.1	149.2	204.9

The design concrete pry-out resistance is derived from $V^0_{Rd,cp} = V^0_{Rk,cp} / \gamma_{Mp,v}$ where the partial safety factor is 1.5. The recommended load is derived from $V^0_{Rec,cp} = V^0_{Rd,cp} / \gamma_F$ where the partial safety factor is 1.4.

COMBINED TENSION & SHEAR

Combined Tension & Shear: $\frac{N_{Sd}}{N_{Rd}} + \frac{V_{Sd}}{V_{Rd}} \leq 1.2$

The resultant force must be satisfied to the above conditions. The designer must cross check the loading conditions, types of applied loads and substrate to ensure the recommended anchor is applicable to the actual site applications. This would avoid any design faults which commonly caused by inconclusive load requirements with respective to actual site conditions.

INFLUENCING FACTORS - TENSION

INFLUENCE OF ANCHORAGE DEPTH [$\Psi_{h,N}$]

$\Psi_{h,N} = \frac{h_{act}}{h_{ef,std}}$ Limits: $h_{ef,min} \leq h_{act} \leq 12 * d$

INFLUENCE OF CONCRETE STRENGTH ON PULL-OUT AND CONCRETE CONE RESISTANCE [$\Psi_{\beta,N}$]

$\Psi_{\beta,N} = \left(\frac{f_{ck,cube}}{25}\right)^{0.3}$ Limits: $25\ \text{MPa} \leq f_{ck,cube} \leq 60\ \text{MPa}$

Concrete Strength Designation (ENV 206)		C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 50/60
Concrete Cylinder Strength, $f_{ck,cyl}$	[MPa]	20	25	30	35	40	50
Concrete Cube Strength, $f_{ck,cube}$	[MPa]	25	30	37	45	50	60
Concrete Strength Factor, $\psi_{\beta,N}$		1.00	1.06	1.12	1.19	1.23	1.30

INFLUENCE OF ANCHOR SPACING [$\psi_{s,N}$]

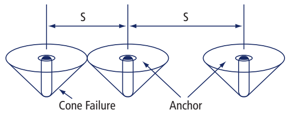
Anchor Spacing 's' [mm]	M8	M10	M12	M16	M20	M24
40	0.63					
45	0.64	0.63				
55	0.67	0.65	0.63			
65	0.70	0.68	0.65	0.63		
85	0.77	0.74	0.69	0.67	0.63	
105	0.83	0.79	0.74	0.71	0.65	0.63
135	0.92	0.88	0.81	0.77	0.70	0.66
150	0.97	0.92	0.84	0.80	0.72	0.68
160	1.00	0.94	0.86	0.82	0.74	0.69
180		1.00	0.91	0.86	0.76	0.71
220			1.00	0.94	0.82	0.76
250				1.00	0.87	0.80
340					1.00	0.90
420						1.00
Critical Spacing 's_{cr}' [mm]	160	180	220	250	340	420
Minimum Spacing 's_{min}' [mm]	40	45	55	65	85	105

$\Psi_{s,N} = 0.5 + \frac{s}{4 * h_{ef,std}}$

Limits: $s_{min} \leq s \leq s_{cr}$

$s_{min} = 0.5 * h_{ef,std}$

$s_{cr} = 2.0 * h_{ef,std}$



INFLUENCE OF EDGE DISTANCE [$\psi_{c,N}$]

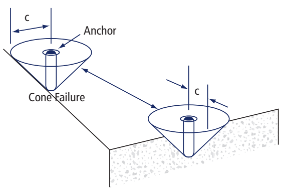
Edge Distance 'c' [mm]	M8	M10	M12	M16	M20	M24
40	0.65					
45	0.69	0.65				
55	0.78	0.73	0.65			
65	0.87	0.81	0.71	0.66		
80	1.00	0.92	0.81	0.75		
85		0.96	0.84	0.78	0.65	
90		1.00	0.87	0.80	0.67	
105			0.97	0.89	0.73	0.65
110			1.00	0.92	0.75	0.67
125				1.00	0.81	0.72
170					1.00	0.87
210						1.00
Critical Edge Distance 'c_{cr}' [mm]	80	90	110	125	170	210
Minimum Edge Distance 'c_{min}' [mm]	40	45	55	65	85	105

$\Psi_{c,N} = 0.3 + 0.7 * \frac{c}{h_{ef,std}}$

Limits: $c_{min} \leq c \leq c_{cr}$

$c_{min} = 0.5 * h_{ef,std}$

$c_{cr} = 1.0 * h_{ef,std}$



INFLUENCING FACTORS - SHEAR

INFLUENCE OF CONCRETE STRENGTH ON CONCRETE EDGE SHEAR AND CONCRETE PRY-OUT RESISTANCE [$\Psi_{\beta,V}$]

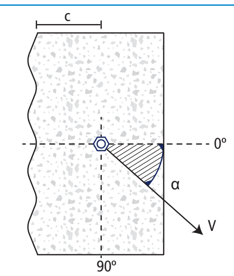
$$\Psi_{\beta,V} = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits: 25 MPa $\leq f_{ck,cube} \leq$ 60 MPa

Concrete Strength Designation (ENV 206)		C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 50/60
Concrete Cylinder Strength, $f_{ck,cyl}$	[MPa]	20	25	30	35	40	50
Concrete Cube Strength, $f_{ck,cube}$	[MPa]	25	30	37	45	50	60
Concrete Strength Factor, $\psi_{\beta,V}$		1.00	1.10	1.22	1.34	1.41	1.55

INFLUENCE OF SHEAR LOAD DIRECTION [$\Psi_{\alpha,V}$]

Load Type	Angle, α [°]	$\Psi_{\alpha,V}$
Oblique 0°	0° < α ≤ 15°	1.00
Oblique 30°	15° < α ≤ 37.5°	1.14
Oblique 45°	37.5° < α ≤ 52.5°	1.35
Oblique 60°	52.5° < α ≤ 67.5°	1.71
Oblique 90°	67.5° < α ≤ 90°	2.00



INFLUENCE OF ANCHOR SPACING AND EDGE DISTANCE ON CONCRETE EDGE SHEAR RESISTANCE [$\Psi_{sc,V}$]

$$\Psi_{sc,V} = \frac{c}{c_{min}} * \sqrt{\frac{c}{c_{min}}}$$

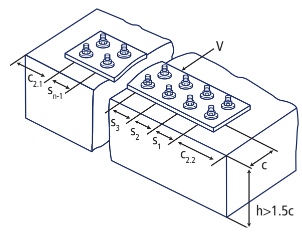
for single anchor towards a concrete edge

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

for two anchors when $s \leq 3c$

$$\Psi_{sc,V} = \frac{3c + s_1 + s_2 + s_{n-1}}{3nc_{min}} * \sqrt{\frac{c}{c_{min}}}$$

for multiple anchors when s_1 to $s_{n-1} \leq 3c$ and $c_2 \geq 1.5c$



$\Psi_{sc,V}$		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	3.4	3.6	3.8	4.0
Edge influence with single anchor		1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72	6.27	6.83	7.41	8.00
s/c_{min}	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	3.44	3.73	4.03	4.33
	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	3.60	3.89	4.19	4.50
	2.0	0.83	1.02	1.22	1.43	1.65	1.89	2.13	2.38	2.63	2.90	3.18	3.46	3.75	4.05	4.35	4.67
	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	3.90	4.21	4.52	4.83
	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	4.06	4.36	4.68	5.00
	3.5		1.30	1.52	1.75	1.99	2.24	2.50	2.76	3.04	3.32	3.61	3.91	4.21	4.52	4.84	5.17
	4.0			1.62	1.86	2.10	2.36	2.62	2.89	3.17	3.46	3.75	4.05	4.36	4.68	5.00	5.33
	4.5				1.96	2.21	2.47	2.74	3.02	3.31	3.60	3.90	4.20	4.52	4.84	5.17	5.50
	5.0					2.33	2.59	2.87	3.15	3.44	3.74	4.04	4.35	4.67	5.00	5.33	5.67
	5.5						2.71	2.99	3.28	3.57	3.88	4.19	4.50	4.82	5.15	5.49	5.83
	6.0						2.83	3.11	3.41	3.71	4.02	4.33	4.65	4.98	5.31	5.65	6.00
	6.5							3.24	3.53	3.84	4.16	4.47	4.80	5.13	5.47	5.82	6.17
	7.0								3.67	3.98	4.29	4.62	4.95	5.29	5.63	5.98	6.33
	7.5									4.11	4.43	4.76	5.10	5.44	5.79	6.14	6.50
	8.0										4.57	4.91	5.25	5.59	5.95	6.30	6.67
	8.5											5.05	5.40	5.75	6.10	6.47	6.83
	9.0											5.20	5.55	5.90	6.26	6.63	7.00
	9.5												5.69	6.05	6.42	6.79	7.17
	10.0													6.21	6.58	6.95	7.33
	10.5														6.74	7.12	7.50
	11.0															7.28	7.67
	11.5																7.83
	12.0																8.00

EAC80 VINYLESTER STYRENE FREE INJECTION SYSTEM FOR POST-INSTALLED REBAR APPLICATIONS

(Design Load Approach with BS8110 Bond Strength Method)

Concrete Compressive Strength: $f_{ck,cube}$ = 25 N/mm²

Rebar Size, d_s		**ϕ8**	**ϕ10**	**ϕ12**	**ϕ16**	**ϕ20**	**ϕ25**
Design Steel Resistance, $N_{Rd,s}$	[kN]	20.1	31.4	45.2	80.4	125.7	196.4
Design Bond Stress, τ_{Rd}	[N/mm²]	5.6	4.4	5.0	5.3	4.7	4.7
Drilled Hole Diameter, d_o	[mm]	10 ~ 12	13 ~ 14	15 ~ 16	20 ~ 22	25 ~ 28	30 ~ 32
Bar Spacing, s	[mm]	50	50	65	80	100	125
Edge Distance, c	[mm]	40	40	40	40	50	65
$L_{b,rqd}$ / Rebar ϕ		18	22	20	19	21	21
Anchorage Length, L_b [mm]		Design Tensile Bonding Capacity, N_{Rd} [kN]					
80		11.2					
100		14.0	14.0		*"Minimum depth to develop full steel shear"*		
120		16.8	16.8	22.6			
160		**20.1**	22.3	30.2	42.5		
200			27.9	37.7	53.1	59.3	
225			**31.4**	42.4	59.7	66.8	
250				**45.2**	66.3	74.2	92.7
305					**80.4**	90.5	113.1
350						103.9	129.8
400						118.7	148.4
425						**125.7**	157.6
500							185.5
530							**196.4**
Length to Develop Steel Yield, $L_{b,rqd}$ [mm]		144	225	240	303	424	529

1) Safety factor for design tensile steel resistance: $\gamma_{Ms,N}$ = 1.15 (based on steel yield strength of 460 N/mm²).
2) Safety factor for design tensile pull-out resistance: $\gamma_{Mc,N}$ = 1.8.
3) Loading applicable to non-cracked concrete with design comply in accordance to BS8110.
4) Loading data conformed to ETA-17/0409 ETAG 001 Part 1& Part 5 Option 7.
5) Safety factor for design tensile concrete cone resistance: $\gamma_{Mc,N}$ = 1.5
6) Minimum spacing shall be $4d_s$ bar to bar or $5d_s$ centre-to-centre.
7) Minimum edge distance shall be $2d_s$ bar to bar or $2.5d_s$ centre-to-centre.

APPROVAL LISTING

European Technical Approval - Option 7 for Non-Cracked Concrete
ETA 17/0409

ÉMISSIONS DANS L'AIR INTÉRIEUR

WRAS APPROVED MATERIAL

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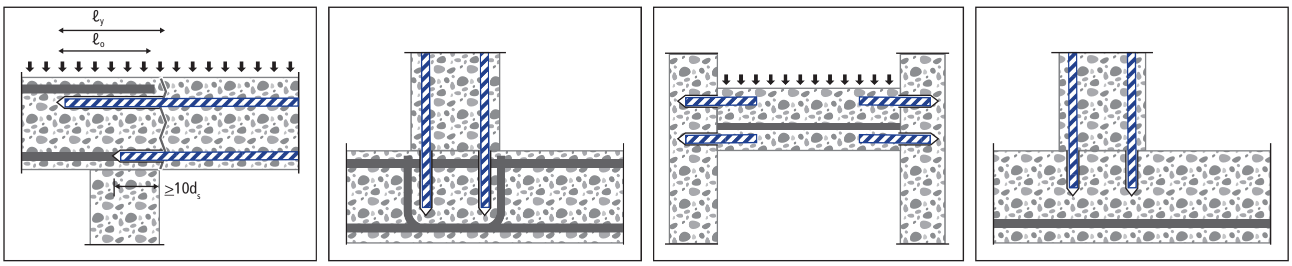

Overlap joints for slabs and beams or foundation column or wall; rebar connection for simply supported slabs or beams; shear connector or compression component joints.

Important note: Architect or design engineer must conduct final checked with the actual site condition for any variations against tabulated data.

EAC80 VINYLESTER STYRENE FREE INJECTION SYSTEM FOR POST-INSTALLED REBAR APPLICATIONS

(Design Load Approach with BS8110 Bond Strength Method)

Concrete Compressive Strength: $f_{ck,cube}$ = 30 N/mm²

Rebar Size, d_s		ϕ8	ϕ10	ϕ12	ϕ16	ϕ20	ϕ25
Design Steel Resistance, $N_{Rd,s}$	[kN]	20.1	31.4	45.2	80.4	125.7	196.4
Design Bond Stress, τ_{Rd}	[N/mm²]	5.9	4.7	5.3	5.6	5.0	5.0
Drilled Hole Diameter, d_o	[mm]	10 ~ 12	13 ~ 14	15 ~ 16	20 ~ 22	25 ~ 28	30 ~ 32
Bar Spacing, s	[mm]	50	50	65	80	100	125
Edge Distance, c	[mm]	40	40	40	40	50	65
$L_{b,rqd}$ / Rebar ϕ		17	21	19	18	20	20
Anchorage Length, L_b [mm]		Design Tensile Bonding Capacity, N_{Rd} [kN]					
80		11.8					
100		14.8	14.8				
120		17.8	17.8	24.0			
160		**20.1**	23.7	32.0	45.0		
200			29.6	40.0	56.2	62.9	
210			**31.4**	42.0	59.1	66.1	
250				**45.2**	70.3	78.6	98.3
285					**80.4**	89.6	112.1
350						110.1	137.6
400						**125.7**	157.3
425							167.1
500							**196.4**
Length to Develop Steel Yield, $L_{b,rqd}$ [mm]		136	212	226	286	400	500

"Minimum depth to develop full steel shear"

1) Safety factor for design tensile steel resistance: $\gamma_{Ms,N}$ = 1.15 (based on steel yield strength of 460 N/mm²).
2) Safety factor for design tensile pull-out resistance: $\gamma_{Mc,N}$ = 1.8.
3) Loading applicable to non-cracked concrete with design comply in accordance to BS8110.
4) Loading data conformed to ETA-17/0409 ETAG 001 Part 1 & Part 5 Option 7.
5) Safety factor for design tensile concrete cone resistance: $\gamma_{Mc,N}$ = 1.5
6) Minimum spacing shall be $4d_s$ bar to bar or $5d_s$ centre-to-centre.
7) Minimum edge distance shall be $2d_s$ bar to bar or $2.5d_s$ centre-to-centre.

APPROVAL LISTING

ETA — European Technical Approval - Option 7 for Non-Cracked Concrete — ETA 17/0409

ÉMISSIONS DANS L'AIR INTÉRIEUR — A (A+ A B C)

WRAS APPROVED MATERIAL

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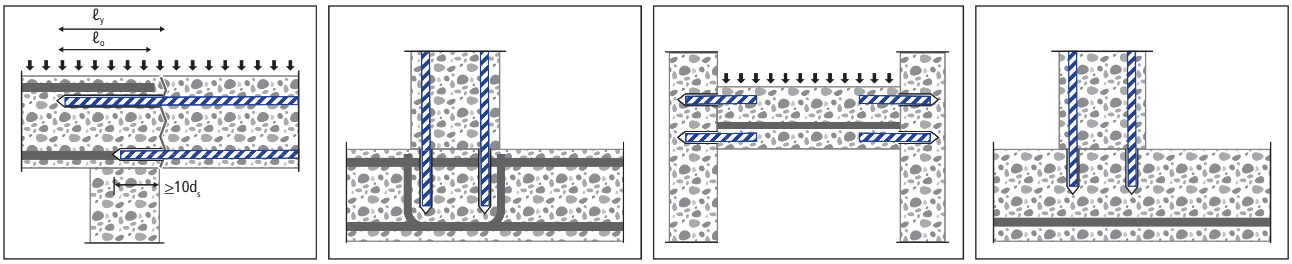

Overlap joints for slabs and beams or foundation column or wall; rebar connection for simply supported slabs or beams; shear connector or compression component joints.

Important note: Architect or design engineer must conduct final checked with the actual site condition for any variations against tabulated data.

EAC80 VINYLESTER STYRENE FREE INJECTION SYSTEM FOR POST-INSTALLED REBAR APPLICATIONS

(Design Load Approach with BS8110 Bond Strength Method)

Concrete Compressive Strength: $f_{ck,cube}$ = 35 N/mm²

Rebar Size, d_s		ϕ8	ϕ10	ϕ12	ϕ16	ϕ20	ϕ25
Design Steel Resistance, $N_{Rd,s}$	[kN]	20.1	31.4	45.2	80.4	125.7	196.4
Design Bond Stress, τ_{Rd}	[N/mm²]	6.2	4.9	5.6	5.9	5.2	5.2
Drilled Hole Diameter, d_o	[mm]	10 ~ 12	13 ~ 14	15 ~ 16	20 ~ 22	25 ~ 28	30 ~ 32
Bar Spacing, s	[mm]	50	50	65	80	100	125
Edge Distance, c	[mm]	40	40	40	40	50	65
$L_{b,rqd}$ / Rebar ϕ		18	22	20	19	21	21
Anchorage Length, L_b [mm]		Design Tensile Bonding Capacity, N_{Rd} [kN]					
80		12.4					
100		15.5	15.5		*"Minimum depth to develop full steel shear"*		
120		18.6	18.6	25.1			
160		**20.1**	24.8	33.5	47.1		
200			31.0	41.9	58.9	65.9	
205			**31.4**	42.9	60.4	67.5	
250				**45.2**	73.6	82.3	102.9
275					**80.4**	90.6	113.2
380						**125.7**	156.5
400							164.7
425							175.0
475							**196.4**
Length to Develop Steel Yield, $L_{b,rqd}$ [mm]		130	203	216	273	382	477

1) Safety factor for design tensile steel resistance: $\gamma_{Ms,N}$ = 1.15 (based on steel yield strength of 460 N/mm²).
2) Safety factor for design tensile pull-out resistance: $\gamma_{Mc,N}$ = 1.8.
3) Loading applicable to non-cracked concrete with design comply in accordance to BS8110.
4) Loading data conformed to ETA-17/0409 ETAG 001 Part 1 & Part 5 Option 7.
5) Safety factor for design tensile concrete cone resistance: $\gamma_{Mc,N}$ = 1.5
6) Minimum spacing shall be $4d_s$ bar to bar or $5d_s$ centre-to-centre.
7) Minimum edge distance shall be $2d_s$ bar to bar or $2.5d_s$ centre-to-centre.

APPROVAL LISTING

European Technical Approval - Option 7 for Non-Cracked Concrete

ETA 17/0409

ÉMISSIONS DANS L'AIR INTÉRIEUR A+ A B C

WRAS APPROVED MATERIAL

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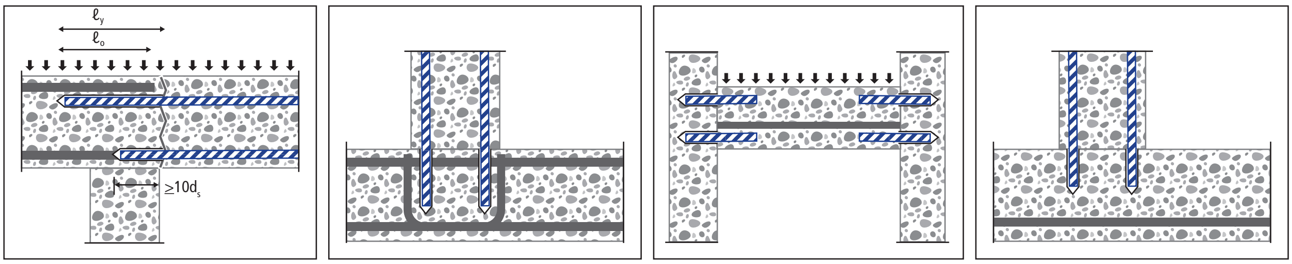
SUGGESTED APPLICATIONS



Overlap joints for slabs and beams or foundation column or wall; rebar connection for simply supported slabs or beams; shear connector or compression component joints.

Important note: Architect or design engineer must conduct final checked with the actual site condition for any variations against tabulated data.

EAC80 VINYLESTER STYRENE FREE INJECTION SYSTEM FOR POST-INSTALLED REBAR APPLICATIONS

(Design Load Approach with BS8110 & ACI 318 Concrete Splitting Criteria)

Concrete Compressive Strength: $f_{ck,cube}$ = 25 N/mm²

Rebar Size, d_s		ϕ8	ϕ10	ϕ12	ϕ16	ϕ20	ϕ25
Design Steel Resistance, $N_{Rd,s}$	[kN]	22.0	34.4	49.6	88.1	137.6	215.1
Splitting Bond Stress, $\tau_{sp,d}$	[N/mm²]	4.15	3.49	3.49	3.49	3.25	2.80
Drilled Hole Diameter, d_o	[mm]	10 ~ 12	13 ~ 14	15 ~ 16	20 ~ 22	25 ~ 28	30 ~ 32
Bar Spacing, s	[mm]	50	50	60	80	100	125
Edge Distance, c	[mm]	40	40	40	40	50	65
$L_{b,rqd}$ / Rebar ϕ		26	31	31	31	34	39
Anchorage Length, L_b [mm]		Design Tensile Pull-Out / Concrete Cone Resistance, N_{Rd} [kN]					
80		8.3					
100		10.4	11.0		*"Minimum depth to develop full steel shear"*		
120		12.5	13.2	15.8			
160		16.7	17.5	21.1	28.1		
200		20.9	21.9	26.3	35.1	40.8	
250		**22.0**	27.4	32.9	43.9	51.1	55.0
300			32.9	39.5	52.6	61.3	66.0
315			**34.4**	41.4	55.3	64.3	69.3
375				**49.6**	65.8	76.6	82.5
450					79.0	91.9	99.0
500					**88.1**	102.1	110.0
600						122.5	132.0
675						**137.6**	148.5
750							165.0
980							**215.1**
Length to Develop Steel Yield, $L_{b,rqd}$ [mm]		211	314	377	502	674	978

1) Design tensile steel resistance: $N_{Rd,s} = f_y * A_s / \gamma_{Ms,N}$ where $\gamma_{Ms,N}$ = 1.05 (based on steel yield of 460 N/mm²).
2) Design value complied in accordance to BS8110 and ACI 318 concrete splitting criteria.
3) Loading data conformed to ETA-17/0409 ETAG 001 Part 1 & Part 5 Option 7.
4) Minimum spacing shall be $4d_s$ bar to bar or $5d_s$ centre-to-centre.
5) Minimum edge distance shall be $2d_s$ bar to bar or $2.5d_s$ centre-to-centre.
6) Applicable to dry and wet concrete application.
7) Design value based on non-cracked concrete.

APPROVAL LISTING

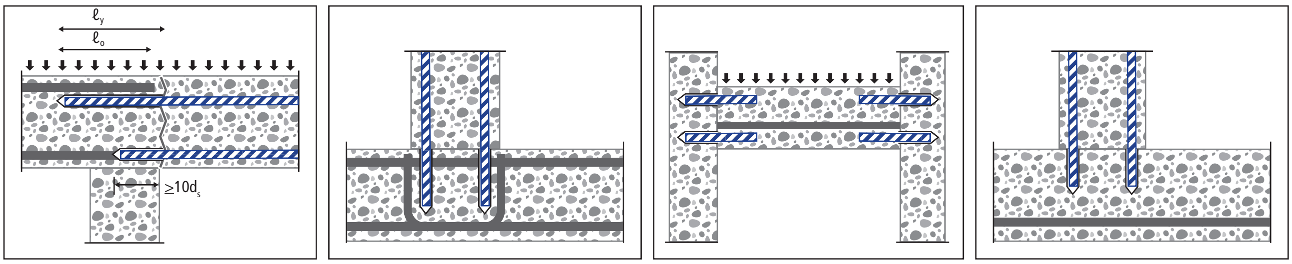
ETA — European Technical Approval - Option 7 for Non-Cracked Concrete — ETA 17/0409

ÉMISSIONS DANS L'AIR INTÉRIEUR — A — A+ A B C

WRAS APPROVED MATERIAL

LEED TESTED

SUGGESTED APPLICATIONS



Overlap joints for slabs and beams or foundation column or wall; rebar connection for simply supported slabs or beams; shear connector or compression component joints.

Important note: Architect or design engineer must conduct final checked with the actual site condition for any variations against tabulated data.

statheros Precisely Engineered

EAC80 VINYLESTER STYRENE FREE INJECTION SYSTEM FOR POST-INSTALLED REBAR APPLICATIONS

(Design Load Approach with BS8110 & ACI 318 Concrete Splitting Criteria)

Concrete Compressive Strength: $f_{ck,cube}$ = 30 N/mm²

Rebar Size, d_s		ϕ8	ϕ10	ϕ12	ϕ16	ϕ20	ϕ25
Design Steel Resistance, $N_{Rd,s}$	[kN]	22.0	34.4	49.6	88.1	137.6	215.1
Splitting Bond Stress, $\tau_{sp,d}$	[N/mm²]	4.64	3.91	3.91	3.91	3.63	3.13
Drilled Hole Diameter, d_o	[mm]	10 ~ 12	13 ~ 14	15 ~ 16	20 ~ 22	25 ~ 28	30 ~ 32
Bar Spacing, s	[mm]	50	50	60	80	100	125
Edge Distance, c	[mm]	40	40	40	40	50	65
$L_{b,rqd}$ / Rebar ϕ		24	28	28	28	30	35
Anchorage Length, L_b [mm]		Design Tensile Pull-Out / Concrete Cone Resistance, N_{Rd} [kN]					
80		9.3					
100		11.7	12.3			*"Minimum depth to develop full steel shear"*	
120		14.0	14.7	17.7			
160		18.7	19.7	23.6	31.5		
200		**22.0**	24.6	29.5	39.3	45.6	
250			30.7	36.9	49.1	57.0	61.5
280			**34.4**	41.3	55.0	63.9	68.8
320				47.2	62.9	73.0	78.7
335				**49.6**	65.8	76.4	82.4
400					78.6	91.2	98.3
450					**88.1**	102.6	110.6
525						119.8	129.1
605						**137.6**	148.7
750							184.4
875							**215.1**
Length to Develop Steel Yield, $L_{b,rqd}$ [mm]		189	280	336	448	603	875

1) Design tensile steel resistance: $N_{Rd,s} = f_y * A_s / \gamma_{Ms,N}$ where $\gamma_{Ms,N}$ = 1.05 (based on steel yield of 460 N/mm²).
2) Design value complied in accordance to BS8110 and ACI 318 concrete splitting criteria.
3) Loading data conformed to ETA-17/0409 ETAG 001 Part 1 & Part 5 Option 7.
4) Minimum spacing shall be $4d_s$ bar to bar or $5d_s$ centre-to-centre.
5) Minimum edge distance shall be $2d_s$ bar to bar or $2.5d_s$ centre-to-centre.
6) Applicable to dry and wet concrete application.
7) Design value based on non-cracked concrete.

APPROVAL LISTING

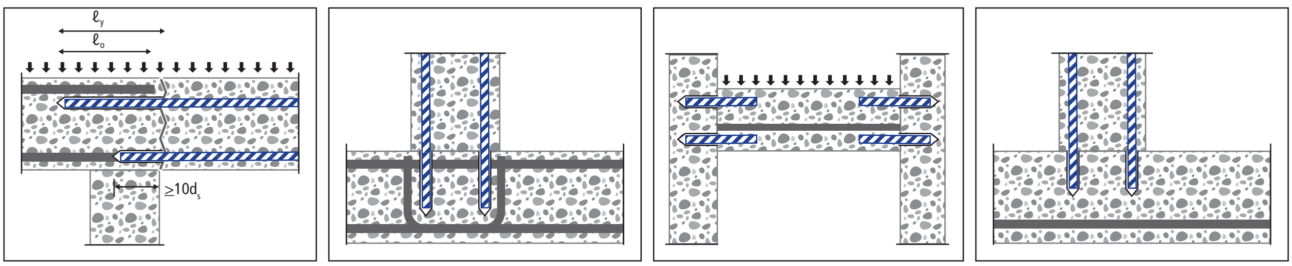
European Technical Approval - Option 7 for Non-Cracked Concrete
ETA 17/0409

ÉMISSIONS DANS L'AIR INTÉRIEUR

WRAS APPROVED MATERIAL

LEED TESTED

SUGGESTED APPLICATIONS



Overlap joints for slabs and beams or foundation column or wall; rebar connection for simply supported slabs or beams; shear connector or compression component joints.

Important note: Architect or design engineer must conduct final checked with the actual site condition for any variations against tabulated data.

EAC80 VINYLESTER STYRENE FREE INJECTION SYSTEM FOR POST-INSTALLED REBAR APPLICATIONS

(Design Load Approach with BS8110 & ACI 318 Concrete Splitting Criteria)

Concrete Compressive Strength: $f_{ck,cube}$ = 35 N/mm²

Rebar Size, d_s		ϕ8	ϕ10	ϕ12	ϕ16	ϕ20	ϕ25
Design Steel Resistance, $N_{Rd,s}$	[kN]	22.0	34.4	49.6	88.1	137.6	215.1
Splitting Bond Stress, $\tau_{sp,d}$	[N/mm²]	4.95	4.17	4.17	4.17	3.88	3.34
Drilled Hole Diameter, d_o	[mm]	10 ~ 12	13 ~ 14	15 ~ 16	20 ~ 22	25 ~ 28	30 ~ 32
Bar Spacing, s	[mm]	50	50	60	80	100	125
Edge Distance, c	[mm]	40	40	40	40	50	65
$L_{b,rqd}$ / Rebar ϕ		22	26	26	26	28	33
Anchorage Length, L_b [mm]		Design Tensile Pull-Out / Concrete Cone Resistance, N_{Rd} [kN]					
80		10.0					
100		12.4	13.1			*"Minimum depth to develop full steel shear"*	
120		14.9	15.7	18.9			
160		19.9	21.0	25.2	33.5		
200		**22.0**	26.2	31.4	41.9	48.8	
250			32.8	39.3	52.4	61.0	65.6
265			**34.4**	41.7	55.6	64.6	69.5
300				47.2	62.9	73.1	78.7
315				**49.6**	66.0	76.8	82.6
375					78.6	91.4	98.4
420					**88.1**	102.4	110.2
450						109.7	118.1
565						**137.6**	148.2
700							183.6
820							**215.1**
Length to Develop Steel Yield, $L_{b,rqd}$ [mm]		177	263	315	420	565	820

1) Design tensile steel resistance: $N_{Rd,s} = f_y * A_s / \gamma_{Ms,N}$ where $\gamma_{Ms,N}$ = 1.05 (based on steel yield of 460 N/mm²).
2) Design value complied in accordance to BS8110 and ACI 318 concrete splitting criteria.
3) Loading data conformed to ETA-17/0409 ETAG 001 Part 1 & Part 5 Option 7.
4) Minimum spacing shall be $4d_s$ bar to bar or $5d_s$ centre-to-centre.
5) Minimum edge distance shall be $2d_s$ bar to bar or $2.5d_s$ centre-to-centre.
6) Applicable to dry and wet concrete application.
7) Design value based on non-cracked concrete.

APPROVAL LISTING

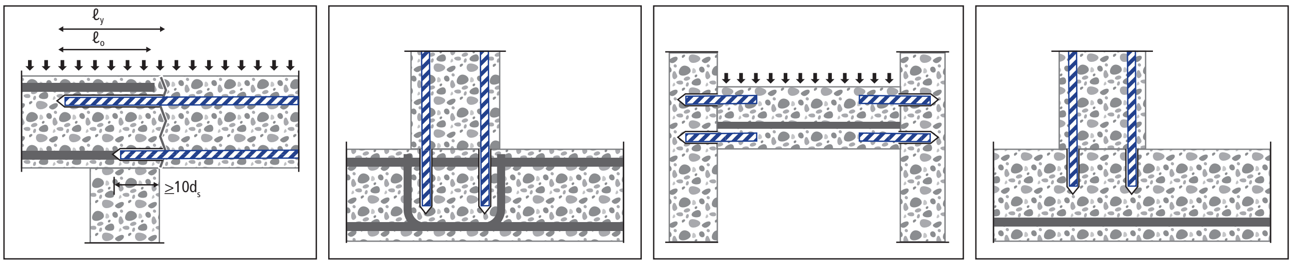
European Technical Approval - Option 7 for Non-Cracked Concrete ETA 17/0409

ÉMISSIONS DANS L'AIR INTÉRIEUR A+ A B C

WRAS APPROVED MATERIAL

LEED TESTED

SUGGESTED APPLICATIONS



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