SPIT EPOBAR

APPLICATIONS

- Reinforcement starter bars,
- reinforcement anchors for diaphragm walls.

LIMITS OF THIS FORMULA

- The effective anchor depth must be ≥ 10 times the diameter of the rebar
- The max. anchor depth will be limited to 900 mm
- In no circumstances will more than two cartridges be used per anchorage.

VINYLESTER RESIN – HIGH PERFORMANCE

Steel reinforcement fixings for reinforced concrete

Sizing rules for steel reinforcement fixings for concrete according to eurocode 2 regulations

The anchorage depth Ls (mm) for the ultimate limit load for rebar F_{RD} (N) is given by following equation:

$$L_S \approx \frac{F_{RD}}{4,71.\eta_1.\eta_2.\varnothing_t.f_{ctk\,5\%}}$$

Concrete strength class	f_{ck} (N/mm²)	$f_{ctk5\%}$ (N/mm²)
C20/25	20	1,5
C25/30	25	1,8
C30/37	30	2,0
C35/45	35	2,2
C40/50	40	2,5
C45/55	45	2,7
C50/60	50	2,9

F_{Rd} Design ultimate load (≤ NRd)

$f_{ctk\,5\%}$ Characteristic tensile strength of concrete in N/mm².

$\varnothing_t$ Drill hole diameter for the $\varnothing_{steel\text{-}bar}$ considered (mm)

η_1 depends on bond conditions
- η_1 =1 (good bond conditions).
See § 8.4.2 (EN 1992-1-1)

η_2 depends on rebar diameter
- η_2 = 1 for Øbar ≤ 32 mm
- η_2 = 0.92 for Øbar = 40 mm

Example

In the concrete C20/25 (using table)

- Rebar diameter : 12 mm
- Hole diameter : 18 mm
- Anchore depth : 280 mm

With this data, we obtain a design resistance equal to 36 kN and we can carry out 8 anchorages with one cartridge of 410 ml.

In the concrete C50/60 (using the formula)

- Characteristic compressive strength : 50 Mpa (base on cylinder)
- Rebar diameter : 16 mm
- Hole diameter : 24 mm
- If the design value of resistance is 60 kN, the necessary anchorage depth is :

$$L_S \approx \frac{60.10^3}{4,71.24.2,9} = 183mm$$

SOCOTEC
N° PX 1117

Rebar fixings Fe E500 with EPOBAR Resin in concrete C20/25 according to EC2 regulations

diameter (mm) bar	hole	Design value of resistance N_{RD} (kN)																						Max N_{RD} bar (kN)	Depth in mm for max N_{Rd} bar
8	10	6	7	8	10	11	13	14	16	17	18	20	21											21,85	309
Nb. Anch. /cart. 410		145	116	97	83	73	64	58	53	48	45	41	39												37,5
8	12	7	8	10	12	14	15	17	19	20														21,85	258
Nb. Anch. /cart. 530		65	52	44	37	33	29	26	24	22															20,3
10	12		8	10	12	14	15	17	19	20	22	24	25	27	29	31	32	34						34,15	403
Nb. Anch. /cart. 410			95	79	68	59	53	47	43	40	37	34	32	30	28	26	25	24							23,6
10	14		10	12	14	16	18	20	22	24	26	28	30	32	34									34,15	345
Nb. Anch. /cart. 410			44	36	31	27	24	22	20	18	17	16	15	14	13										12,6
12	15			13	15	17	19	21	23	25	28	30	32	34	36	38	40	42	48					49,17	464
Nb. Anch. /cart. 410				43	37	32	29	26	23	21	20	18	17	16	15	14	14	13	11						11,1
12	18			15	18	20	23	25	28	31	33	36	38	41	43	46	48							49,17	387
Nb. Anch. /cart. 410				19	17	15	13	12	11	10	8,9	8,3	7,7	7,3	6,8	6,4	6,1								6,0
14	18				18	20	23	25	28	31	33	36	38	41	43	46	48	51	57	64	67			66,93	526
Nb. Anch. /cart. 410					23	20	18	16	15	14	13	12	11	10	10	9,1	8,6	8,2	7,3	6,5	6,2				6,2
14	20				20	23	25	28	31	34	37	40	42	45	48	51	54	57	64					66,93	474
Nb. Anch. /cart. 410					15	13	11	10	9,3	8,5	7,9	7,3	6,8	6,4	6,0	5,7	5,4	5,1	4,5						4,3
16	20					23	25	28	31	34	37	40	42	45	48	51	54	57	64	71	74	78	85	87,42	619
Nb. Anch. /cart. 410						18	16	15	13	12	11	10	10	9,1	8,5	8,1	7,6	7,3	6,4	5,8	5,5	5,3	4,8		4,7
16	24					27	31	34	37	41	44	47	51	54	58	61	64	68	76	85				87,42	516
Nb. Anch. /cart. 410						8,2	7,3	6,5	5,9	5,4	5,0	4,7	4,4	4,1	3,8	3,6	3,4	3,3	2,9	2,6					2,5
Anchorage depth (mm)		80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	450	500	525	550	600		

diameter (mm) bar	hole	Design value of resistance N_{RD} (kN)																						Max N_{RD} bar (kN)	Depth in mm for max N_{Rd} bar
20	25	35	40	44	49	53	57	62	66	71	75	79	84	88	93	97	106	115	124	132				136,6	773
Nb. Anch. /cart. 410		23	19	15	13	12	10	9,3	8,4	7,7	7,1	6,6	6,2	5,8	5,5	5,2	4,9	4,6	4,1	3,7					2,4
20	28	40	45	49	54	59	64	69	74	79	84	89	94	99	104	109	119	129						136,6	691
Nb. Anch. /cart. 410		14	11	9,1	7,8	6,8	6,0	5,4	4,9	4,5	4,2	3,9	3,6	3,4	3,2	3,0	2,9	2,7							1,6
25	30			53	58	64	69	74	79	85	90	95	101	106	111	117	127	138	148	159	170	180	191	213,4	1007
Nb. Anch. /cart. 410				13	11	9,5	8,4	7,6	6,9	6,3	5,8	5,4	5,1	4,7	4,5	4,2	4,0	3,8	3,4	3,0	2,9	2,8	2,5		1,5
25	32			57	62	68	73	79	85	90	96	102	107	113	119	124	136	147	158	170	181	192	203	213,4	944
Nb. Anch. /cart. 410				8,7	7,5	6,5	5,8	5,2	4,8	4,4	4,0	3,7	3,5	3,3	3,1	2,9	2,8	2,6	2,3	2,1	2,0	1,9	1,7		1,1
32	40						92	99	106	113	120	127	134	141	148	155	170	184	198	212	226	240	254	349,7	1237
Nb. Anch. /cart. 410							4,0	3,6	3,3	3,0	2,8	2,6	2,4	2,3	2,1	2,0	1,9	1,8	1,6	1,5	1,4	1,3	1,2		0,6
40	50									130	138	146	154	177	185	194	212	230	247	265	283	300	318	349,7	1076
Nb. Anch. /cart. 410										1,9	1,8	1,7	1,5	1,5	1,4	1,3	1,2	1,2	1,0	0,9	0,9	0,8	0,8		0,4
Anchorage depth (mm)		200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	600	650	700	750	800	850	900		

spit the right fixing

SPIT EPOBAR

- **VINYLESTER RESIN – HIGH PERFORMANCE**
- **Steel reinforcement fixings for reinforced concrete**

APPLICATIONS

- Reinforcement starter bars,
- reinforcement anchors for diaphragm walls.

FIRE BEHAVIOUR

- See page 24

FIRE TEST

CSTB
Le futur en construction
PV 553 03 0516

Sizing rules for steel reinforcement fixings for concrete using the bond strength

Mechanical Characteristics of rebars

Nominal steel bar Ø		8	10	12	14	16	20	25	32	40
Sections (cm²)		0.503	0.785	1.13	1.54	2.01	3.14	4.91	8.04	12.57
Min. resistances to failure (kN)	Fe E400	21,13	32,97	47,46	64,68	84,42	131,88	206,22	337,68	527,94
	Fe E500	25,90	40,43	58,20	79,31	103,52	161,71	252,87	414,06	647,36
Ultimate limit load N_{Rd} (kN)	**Fe E500**	**21,85**	**34,15**	**49,17**	**66,93**	**87,42**	**136,59**	**213,43**	**349,56**	**546,36**

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

Anchorage length calculated from the bond strength

From the bond strength of the SPIT EPOBAR Resin, the table below gives the minimum anchorage length for rebar Fe E500, in concrete class ≥ C20/25

Rebar Ø (mm)	8	10	12	14	16	20	25	32	40
Ø Drilling (mm)	10	12	15	18	20	25	32	40	50
Min. anchorage length (mm)	**120**	**150**	**180**	**210**	**245**	**305**	**380**	**485**	**605**
Ultimate limit load (kN)	21,85	34,15	49,17	66,93	87,42	136,59	213,43	349,56	546,36
Nb. anchoring / crt. 410	97	63	29	16	12	6.1	2.8	1.5	0.8

Calculation method

- Characteristic bond strength
  τ_{Rk} : 17.85 N/mm² issues from confirmed test and from the calculation using the rebar diameter (available for rebar diameter 8 to 40 mm). [$\tau_{Rk} = \tau_{Ru,m}$ x 0.75].

- Design bond strength τ_{Rd} :

$$\tau_{Rd} = \frac{\tau_{Rk}}{\gamma_M = 2.16} \left[\gamma_M : \text{safety partial factor}\right]$$

- Calculation of the minimum anchorage length of the rebar

$$l_s = \frac{A_s \cdot f_{yk}}{\Pi \cdot \text{Ø}_{fer} \cdot \tau_{Rd}}$$