SVA-VE – Vinylester capsule resin for use in concrete

Bonded anchor with anchor rod made of galvanized steel or stainless steel of sizes M8 to M30 for use in non-cracked concrete

Basic product information

Features

- Styrene free resin (odourless)
- Can be installed in diamond drilled holes
- **STUD** – carbon steel, class 5.8 acc. EN ISO 898-1
- **STUD-88** – carbon steel , class 8.8 acc. EN ISO 898-1
  Coating thickness min. 5µm acc. EN ISO 4042
- **STUD-A4** – stainless steel, grade A4-70, A4-80 acc. EN ISO 3506
  Steel material 1.4401, 1.4404, 1.4571 acc. EN 10088

Substrate

- Non-cracked concrete C20/25 – C50/60 (Option 7)
- Reinforced and unreinforced concrete
- Dry or wet concrete (Category 1)
- Flooded holes, except sea water (Category 2)

Installation guide

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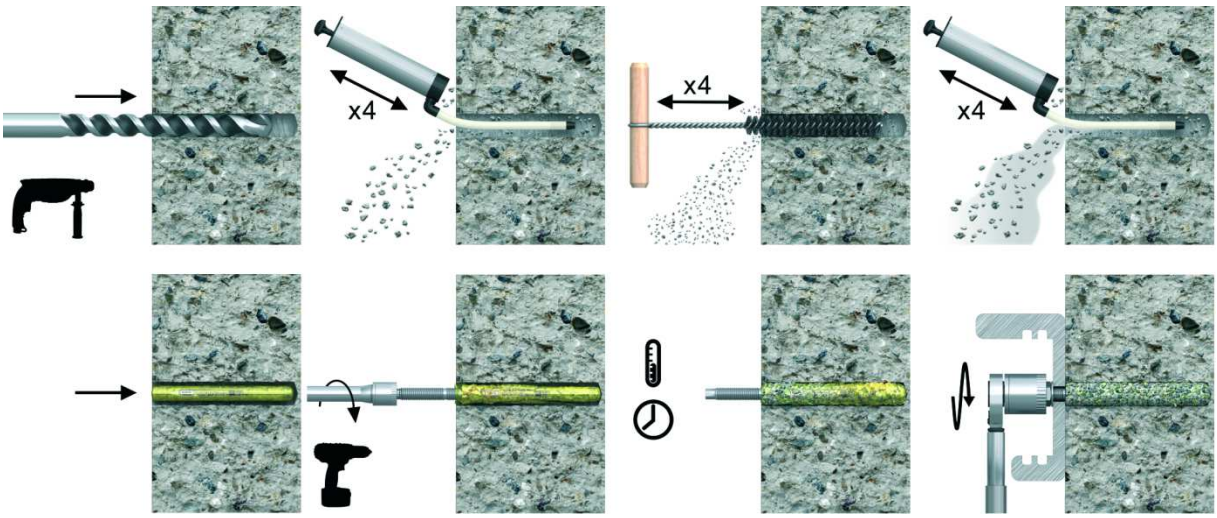

1. Drill hole to the correct diameter and depth for stud size being used.
2. Clean the hole with brush and hand pump at least four times each.
3. Insert capsule into the hole. Connect stud to drilling machine using appropriate driver system.
4. Position the stud into the glass capsule then switch on the drilling machine and drive stud into the capsule. Switch off the drilling machine as soon as the bottom of hole is reached.
5. Leave the anchor undisturbed until the curing time elapses.
6. Attach fixture and tighten the nut to the required torque.

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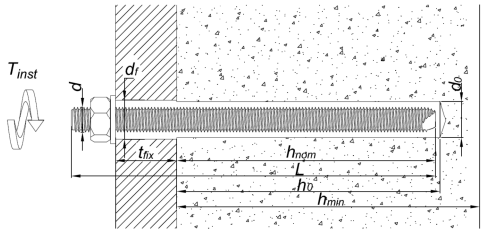
Installation data



Size			M8	M10	M12	M16	M20	M24	M30
Thread diameter	d	[mm]	8	10	12	16	20	24	30
Hole diameter in substrate	d_0	[mm]	10	12	14	18	24	28	35
Installation torque	T_{inst}	[Nm]	10	20	40	80	120	180	300
Wrench size	s_w	[mm]	10	17	19	24	30	36	46
Min. hole depth in substrate	h_0	[mm]	h_{ef} + 5						
Installation depth	h_{nom}	[mm]	80	90	110	125	170	210	270
Min. substrate thickness	h_{min}	[mm]	120	130	140	180	230	270	340
Min. spacing	s_{min}	[mm]	$0.5 \cdot h_{ef} \geq 40$						
Min. edge distance	c_{min}	[mm]	$0.5 \cdot h_{ef} \geq 40$						

Minimum curing and working time

Resin temperature	Concrete temperature	Curing time*	Working time
[°C]	[°C]	[min]	[min]
5	-5	480	-
5	0	240	-
5	5	150	-
10	10	120	-
15	15	90	-
20	20	45	-
25	30	20	-
25	40	10	-

* For wet concrete the curing time must be doubled.

Mechanical properties

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Size				M8	M10	M12	M16	M20	M24	M30
Nominal tensile strength	STUDS	f_{uk}	[N/mm^2]	520	520	520	520	520	520	520
	STUDS-88			800	800	800	800	800	800	800
	STUDS-A4			700	700	700	700	700	700	700
Nominal yield stress	STUDS	f_{yk}	[N/mm^2]	420	420	420	420	420	420	420
	STUDS-88			640	640	640	640	640	640	640
	STUDS-A4			350	350	350	350	350	350	350
Cross-sectional area		A_s	[mm^2]	36.6	58.0	84.3	157.0	245.0	352.8	559.8
Section modulus		W_{el}	[mm^3]	31.2	62.3	109.2	277.5	541.0	935.0	1868.0
Characteristic bending resistance	STUDS	M^0_{Rks}	[Nm]	20	39	68	173	338	583	1166
	STUDS-88			30	60	105	266	519	898	1793
	STUDS-A4			26	52	92	233	454	785	1569
Design bending moment	STUDS	M	[Nm]	11	22	39	99	193	333	666
	STUDS-88			17	34	60	152	297	513	1025
	STUDS-A4			12	24	42	107	208	360	719

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Product information

Size	Product Code			Anchor		Fixture	
				Thread diameter	Length	Max. thickness	Hole diameter
	Steel class 5.8	Steel class 8.8	Steel grade A4	d	L	t_{fix}	d_f
				[mm]	[mm]	[mm]	[mm]
M8	STUDS-08110	STUDS-08110-88	STUDS-08110-A4	8.0	110	20	9.0
	STUDS-08160	-	STUDS-08160-A4	8.0	160	70	9.0
M10	STUDS-10130	STUDS-10130-88	STUDS-10130-A4	10.0	130	28	12.0
	STUDS-10170	-	STUDS-10170-A4	10.0	170	68	12.0
	STUDS-10190	-	STUDS-10190 -A4	10.0	190	88	12.0
M12	STUDS-12160	STUDS-12160-88	STUDS-12160-A4	12.0	160	35	14.0
	STUDS-12190	-	STUDS-12190-A4	12.0	190	65	14.0
	STUDS-12220	-	STUDS-12220-A4	12.0	220	95	14.0
	STUDS-12260	-	STUDS-12260-A4	12.0	260	135	14.0
	STUDS-12300	-	STUDS-12300-A4	12.0	300	175	14.0
M16	STUDS-16190	STUDS-16190-88	STUDS-16190-A4	16.0	190	46	18.0
	STUDS-16220	-	STUDS-16220-A4	16.0	220	76	18.0
	STUDS-16260	-	STUDS-16260-A4	16.0	260	116	18.0
	STUDS-16300	-	STUDS-16300-A4	16.0	300	156	18.0
	STUDS-16380	-	STUDS-16380-A4	16.0	380	236	18.0
M20	STUDS-20260	STUDS-20260-88	STUDS-20260-A4	20.0	260	67	22.0
	STUDS-20300	-	STUDS-20300-A4	20.0	300	107	22.0
	STUDS-20350	-	STUDS-20350-A4	20.0	350	157	22.0
M24	STUDS-24300	STUDS-24300-88	STUDS-24300-A4	24.0	300	62	26.0
M30	STUDS-30380	STUDS-30380-88	STUDS-30380-A4	30.0	380	106	32.0

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Basic performance data for single anchor

Performance data for single anchor without influence of edge distance and spacing.

STANDARD EMBEDMENT DEPTH – NON CRACKED CONCRETE

Size			M8	M10	M12	M16	M20	M24	M30
Embedment depth			**80**	**90**	**110**	**125**	**170**	**210**	**270**
MEAN ULTIMATE LOAD									
STUDS (5.8)	TENSION $N_{RU,m}$	[kN]	21.6	34.8	50.4	75.5	119.2	158.4	239.6
	SHEAR $V_{RU,m}$	[kN]	18.3	29.0	42.2	78.5	122.5	176.5	280.5
STUDS-88 (8.8)	TENSION $N_{RU,m}$	[kN]	28.9	35.9	55.7	75.5	119.2	158.4	239.6
	SHEAR $V_{RU,m}$	[kN]	29.3	46.4	67.4	125.6	196.0	282.4	448.4
STUDS-A4 (A4-70)	TENSION $N_{RU,m}$	[kN]	28.9	35.9	55.7	75.5	119.2	158.4	239.6
	SHEAR $V_{RU,m}$	[kN]	25.6	40.6	59.0	109.9	171.5	247.1	392.7
CHARACTERISTIC LOAD									
STUDS (5.8)	TENSION N_{Rk}	[kN]	18.0	29.0	42.0	60.0	95.0	140.0	200.0
	SHEAR V_{Rk}	[kN]	9.0	14.0	21.0	39.0	61.0	88.0	140.0
STUDS-88 (8.8)	TENSION N_{Rk}	[kN]	25.0	30.0	50.0	60.0	95.0	140.0	200.0
	SHEAR V_{Rk}	[kN]	15.0	23.0	34.0	63.0	98.0	141.0	224.0
STUDS-A4 (A4-70)	TENSION N_{Rk}	[kN]	25.0	30.0	50.0	60.0	95.0	140.0	200.0
	SHEAR V_{Rk}	[kN]	13.0	20.0	29.0	55.0	86.0	124.0	196.0
DESIGN LOAD									
STUDS (5.8)	TENSION N_{Rd}	[kN]	12.0	16.7	27.8	33.3	52.8	77.8	111.1
	SHEAR V_{Rd}	[kN]	7.2	11.2	16.8	31.2	48.8	70.4	112.0
STUDS-88 (8.8)	TENSION N_{Rd}	[kN]	13.9	16.7	27.8	33.3	52.8	7.8	111.1
	SHEAR V_{Rd}	[kN]	12.0	18.4	17.2	50.4	78.4	112.8	179.2
STUDS-A4 (A4-70)	TENSION N_{Rd}	[kN]	13.9	16.7	27.8	33.3	52.8	7.8	111.1
	SHEAR V_{Rd}	[kN]	8.3	12.8	18.6	35.3	55.1	79.5	125.6
RECOMMENDED LOAD*									
STUDS (5.8)	TENSION N_{Rec}	[kN]	8.6	11.9	19.8	23.8	37.7	55.6	79.4
	SHEAR V_{Rec}	[kN]	5.1	8.0	12.0	22.3	34.9	50.3	80.0
STUDS-88 (8.8)	TENSION N_{Rec}	[kN]	9.9	11.9	19.8	23.8	37.7	55.6	79.4
	SHEAR V_{Rec}	[kN]	8.6	13.1	19.4	36.0	56.0	80.6	128.0
STUDS-A4 (A4-70)	TENSION N_{Rec}	[kN]	9.9	11.9	19.8	23.8	37.7	55.6	79.4
	SHEAR V_{Rec}	[kN]	5.9	9.1	13.3	25.2	39.4	56.8	89.7
				Steel failure					

*Partial safety factor 1.4

Performance data for dry or wet concrete (Category 1) and flooded holes, except sea water (Category 2)
In the area of reinforcement with (Ø≤10mm with spacing <100mm or Ø>10mm with spacing <150mm) use partial safety factor
$\psi_{re} = 0.5 + h_{ef} / 200 \leq 1$

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Basic performance data for single anchor (cont.)

Edge distance and spacing

Edge distance (tensile)

Reduction factors for edge distance $<c_{cr,N}$ applicable to N_{Rd} or N_{rec} for non-cracked concrete

Table only valid for one edge $<c_{cr,N}$ and $s \geq s_{cr,N}$

c_N [mm]	M8		M10		M12		M16		M20	M24	M30	
	$h \geq 1.33h_{min}$	h_{min}	$h \geq 1.38h_{min}$	h_{min}	$h \geq 1.57h_{min}$	h_{min}	$h \geq 1.39h_{min}$	h_{min}	$\geq h_{min}$	$\geq h_{min}$	$h \geq 1.41h_{min}$	h_{min}
40	0.53	0.48	-	-	-	-	-	-	-	-	-	-
45	0.56	0.50	0.53	0.48	-	-	-	-	-	-	-	-
55	0.61	0.53	0.58	0.51	0.53	0.50	-	-	-	-	-	-
63	0.65	0.56	0.62	0.54	0.56	0.52	0.53	0.50	-	-	-	-
85	0.78	0.65	0.72	0.61	0.65	0.59	0.61	0.56	0.53	-	-	-
105	0.90	0.73	0.83	0.68	0.73	0.66	0.68	0.62	0.58	0.53	-	-
120	1.00	0.80	0.91	0.74	0.79	0.71	0.73	0.66	0.62	0.56	-	-
135	-	0.84	1.00	0.80	0.86	0.76	0.79	0.71	0.66	0.59	0.57	0.55
165	-	0.91	-	0.87	1.00	0.88	0.91	0.80	0.74	0.65	0.63	0.60
190	-	0.98	-	0.92	-	0.93	1.00	0.88	0.81	0.71	0.68	0.64
200	-	1.00	-	0.94	-	0.95	1.00	0.90	0.83	0.73	0.70	0.66
225	-	-	-	1.00	-	1.00	-	0.95	0.91	0.78	0.75	0.70
255	-	-	-	-	-	-	-	1.00	1.00	0.85	0.81	0.75
315	-	-	-	-	-	-	-	-	-	1.00	0.95	0.87
340	-	-	-	-	-	-	-	-	-	-	1.00	0.92
405	-	-	-	-	-	-	-	-	-	-	-	1.00

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Basic performance data for single anchor (cont.)

Edge distance (shear)

Increasing factors for edge distance >c_{min} applicable to $V_{Rd,c}$ for non-cracked concrete

Tables only valid for one edge >c_{min} and s ≥ $3c_V$

c_V [mm]	M8		M10		M12		M16		M20		M24		M30	
	h≥ $1.5c_V$	h_{min}	h≥ $1.5c_V$	h_{min}	h≥ $1.5c_V$	h_{min}	h≥ $1.5c_V$	h_{min}	h≥ $1.5c_V$	h_{min}	h≥ $1.5c_V$	h_{min}	h≥ $1.5c_V$	h_{min}
40	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-
45	1.19	1.19	1.00	1.00	-	-	-	-	-	-	-	-	-	-
55	1.61	1.61	1.35	1.35	1.00	1.00	-	-	-	-	-	-	-	-
63	1.98	1.98	1.66	1.66	1.23	1.23	1.00	1.00	-	-	-	-	-	-
85	3.10	2.88	2.60	2.52	1.92	1.92	1.57	1.57	1.00	1.00	-	-	-	-
105	4.25	3.55	3.56	3.11	2.64	2.49	2.15	2.13	1.37	1.37	1.00	1.00	-	-
120	-	4.06	4.35	3.56	3.22	2.84	2.63	2.44	1.68	1.68	1.22	1.22	-	-
135	-	-	5.20	4.00	3.85	3.20	3.14	2.74	2.00	2.00	1.46	1.46	1.00	1.00
150	-	-	-	4.44	4.50	3.55	3.67	3.05	2.34	2.31	1.71	1.71	1.17	1.17
180	-	-	-	-	5.92	4.26	4.83	3.66	3.08	2.77	2.24	2.23	1.54	1.54
225	-	-	-	-	-	5.33	6.75	4.57	4.31	3.46	3.14	2.78	2.15	2.15
250	-	-	-	-	-	-	7.90	5.08	5.04	3.85	3.67	3.09	2.52	2.40
300	-	-	-	-	-	-	-	6.10	-	4.62	4.83	3.71	3.31	2.88
350	-	-	-	-	-	-	-	7.12	-	-	-	4.33	4.17	3.36
400	-	-	-	-	-	-	-	-	-	-	-	4.95	5.10	3.84
450	-	-	-	-	-	-	-	-	-	-	-	-	-	4.32
500	-	-	-	-	-	-	-	-	-	-	-	-	-	4.80
550	-	-	-	-	-	-	-	-	-	-	-	-	-	5.28

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Basic performance data for single anchor (cont.)

Spacing

Reduction factors for spacing $<s_{cr,N}$ applicable to N_{Rd} / V_{Rd} or N_{rec} / V_{rec} for non-cracked concrete

Table only valid for one spacing $<s_{cr,N}$ and $c \geq c_{cr,N}$

s [mm]	M8		M10		M12		M16		M20	M24	M30	
	$h \geq 1.33h_{min}$	h_{min}	$h \geq 1.38h_{min}$	h_{min}	$h \geq 1.57h_{min}$	h_{min}	$h \geq 1.39h_{min}$	h_{min}	$\geq h_{min}$	$\geq h_{min}$	$h \geq 1.41h_{min}$	h_{min}
40	0,58	0,55	-	-	-	-	-	-	-	-	-	-
45	0,59	0,56	0,58	0,55	-	-	-	-	-	-	-	-
55	0,61	0,57	0,60	0,56	0,58	0,56	-	-	-	-	-	-
63	0,63	0,58	0,62	0,57	0,60	0,57	0,58	0,56	-	-	-	-
85	0,68	0,61	0,66	0,59	0,63	0,60	0,61	0,59	0,58	-	-	-
105	0,72	0,63	0,69	0,62	0,66	0,62	0,64	0,61	0,60	0,58	-	-
135	0,78	0,67	0,75	0,65	0,70	0,65	0,68	0,64	0,63	0,61	0,60	0,58
150	0,81	0,69	0,78	0,67	0,73	0,67	0,70	0,65	0,65	0,62	0,61	0,59
200	0,92	0,75	0,87	0,72	0,80	0,73	0,77	0,70	0,70	0,66	0,65	0,62
250	1,00	0,81	0,96	0,78	0,88	0,78	0,83	0,75	0,75	0,70	0,69	0,65
300	-	0,88	1,00	0,83	0,95	0,84	0,90	0,80	0,79	0,74	0,72	0,69
350	-	0,94	-	0,89	1,00	0,90	0,97	0,85	0,84	0,78	0,76	0,72
400	-	1,00	-	0,94	-	0,95	1,00	0,90	0,89	0,82	0,80	0,75
450	-	-	-	1,00	-	1,00	-	0,95	0,94	0,86	0,83	0,78
510	-	-	-	-	-	-	-	1,00	1,00	0,90	0,88	0,81
550	-	-	-	-	-	-	-	-	-	0,94	0,91	0,84
600	-	-	-	-	-	-	-	-	-	0,98	0,94	0,87
680	-	-	-	-	-	-	-	-	-	1,00	1,00	0,92
810	-	-	-	-	-	-	-	-	-	-	-	1,00

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Design performance data for group of anchors

Size				M8	M10	M12	M16	M20	M24	M30
TENSION LOAD										
STEEL FAILURE (TR 029, 5.2.2.2)										
Steel class 5.8 Characteristic resistance		N_{Rks}	[kN]	18.0	29.0	42.0	78.0	122.0	176.0	280.0
Partial safety factor		γ_{Ms}	-				1.5			
Steel class 8.8 Characteristic resistance		N_{Rks}	[kN]	29.0	46.0	67.0	126.0	196.0	282.0	449.0
Partial safety factor		γ_{Ms}	-				1.5			
Steel class A4-70 Characteristic resistance		N_{Rks}	[kN]	26.0	41.0	59.0	110.0	171.0	247.0	393.0
Partial safety factor		γ_{Ms}	-				1.87			
PULL-OUT FAILURE (acc.TR 029, 5.2.2.3)										
NON-CRACKED CONCRETE C20/25 (CHARACTERISTIC RESISTANCE ACC. 5.2a $N^0_{Rk,p} = \pi \cdot d \cdot h_{ef} \cdot \tau_{Rk}$										
Characteristic bond resistance (Temp range II 80°C/50°C)		$\tau_{Rk.ucr}$	[N/mm²]	10.0	11.0	10.0	9.0	7.5	7.0	5.5
Partial safety factor for use category 1 + 2		γ_{Mp}	-				1.8			
Increasing factors for τ_{ucr}	C30/37	Ψ_c	-	1.04	1.04	1.04	1.04	1.04	1.00	1.00
	C40/50	Ψ_c	-	1.07	1.07	1.07	1.07	1.07	1.00	1.00
	C50/60	Ψ_c	-	1.09	1.09	1.09	1.09	1.09	1.00	1.00
CONCRETE CONE FAILURE (acc.TR 029, 5.2.2.4)										
Effective embedment depth		h_{ef}	[mm]	80	90	110	125	170	210	270
Partial safety factor for use category 1 + 2*		γ_{Mc}	-				1.8			
CONCRETE SPLITTING FAILURE (acc.TR 029, 5.2.2.6)										
Effective embedment depth		h_{ef}	[mm]	80	90	110	125	170	210	270
Edge distance	$h = h_{min}$	$c_{cr,sp}$	[mm]	200	225	220	250	255	315	405
	$h_{min} < h < 2 \cdot h_{ef}$	$c_{cr,sp}$	[mm]	From linear interpolation (drawing 1)						
	$h \geq 2 \cdot h_{ef}$	$c_{cr,sp}$	[mm]	120	135	165	190	255	315	405
Spacing		$S_{cr,sp}$	[mm]	400	450	440	500	510	630	810
Partial safety factor for use category 1 + 2*		γ_{Mc}	-				1.8			

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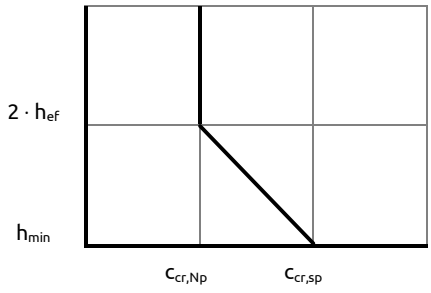
Design performance data for group of anchors

Size			M8	M10	M12	M16	M20	M24	M30
SHEAR LOAD									
STEEL FAILURE (TR 029, 5.2.3.2)									
Steel class 5.8 Characteristic resistance without lever arm	V_{Rks}	[kN]	9.0	14.0	21.0	39.0	61.0	88.0	140.0
Steel class 5.8 Characteristic resistance with lever arm	$M^0_{Rk,s}$	[Nm]	19.0	37.0	65.0	166.0	324.0	561.0	1124.0
Partial safety factor	γ_{Ms}	-				1.25			
Steel class 8.8 Characteristic resistance without lever arm	V_{Rks}	[kN]	15.0	23.0	34.0	63.0	98.0	141.0	224.0
Steel class 8.8 Characteristic resistance with lever arm	$M^0_{Rk,s}$	[Nm]	30.0	60.0	105.0	266.0	519.0	898.0	1799.0
Partial safety factor	γ_{Ms}	-				1.25			
Steel class A4-70 Characteristic resistance without lever arm	V_{Rks}	[kN]	13.0	20.0	29.0	55.0	86.0	124.0	196.0
Steel class A4-70 Characteristic resistance with lever arm	$M^0_{Rk,s}$	[Nm]	26.0	52.0	92.0	233.0	454.0	786.0	1574.0
Partial safety factor	γ_{Ms}	-				1.56			
PRYOUT FAILURE (TR 029 5.2.3.3)									
Factor	k	-	2	2	2	2	2	2	2
Partial safety factor	γ_{Ms}	-				1.5			
CONCRETE EDGE FAILURE (TR 029 5.2.3.4)									
Diameter	d	[kN]	8	10	12	16	20	24	30
Effective embedment depth	h_{ef}	[mm]	80	90	110	125	170	210	270
Partial safety factor	γ_{Mc}	-				1.5			

* Use category: 1 – dry or wet concrete; 2 – flooded holes



Drawing 1. Curve to determination of $c_{cr,sp}$ in case when $h_{min} < h < 2 \cdot h_{ef}$

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