ChemSet™ EPCON™ G5 Xtrem™

SEISMIC ANCHOR STUDS - CHEMICAL INJECTION

AVAILABLE IN NEW ZEALAND ONLY

(Australia refer to ChemSet™ Reo502™ Xtrem™ range)

GENERAL INFORMATION

Performance Related	Material Specification	Installation Related

Product

EPCON™ G5 Xtrem™ is a heavy duty pure Epoxy for anchoring threaded studs and reinforcing bar into cracked and uncracked concrete.

Compliance

European Technical Assessment (option 1) - ETA-25/0648

Design according to:

- NZS 1170.5 - Earthquake Actions
- EN 1992-4 (formerly ETAG001 Annex C, E & TR045)
- NZS 3101 (A3) Section 17 - Seismic Design C1 & C2
- Use enclosed data for simplified calculation method

  Use Ramset™ iExpert Anchor Software for optimised calculation or where a greater range of anchor layout detail is needed.

Benefits, Advantages and Features

- 100 year working life

Greater productivity:

- Anchors in dry, damp, wet or flooded holes
- Easy dispensing even in cold weather

Greater security:

- Strong bond
- Rated for sustained loading

Versatile:

- Anchors in carbide drilled and diamond drilled holes
- Cold and temperate climates

Greater safety:

- Low odour
- VOC Compliant
- Suitable for contact with drinking water

Principal Applications

- Threaded Studs
- Starter Bars
- Threaded Inserts
- Over-head installation
- Steel Columns
- Hand Rails
- Road Stitching

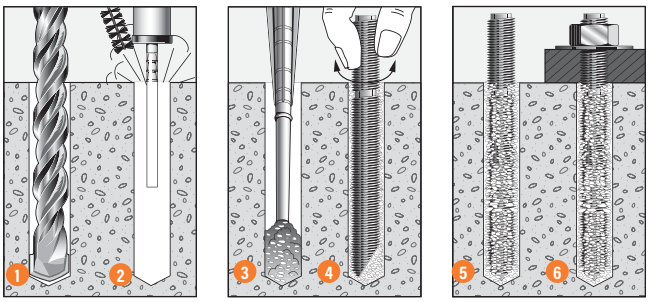
Recommended Installation Temperatures

	Minimum	Maximum
Substrate	5°C	40°C
Adhesive	5°C	40°C

Service Temperature Limits

T1: -40°C to +40°C
T2: -40°C to +60°C
T3: -40°C to +75°C

Installation



1. Drill recommended diameter and depth hole.
2. **Important:** For hammer drilling technique clean dust and debris from hole with stiff wire brush and blower in the following sequence: blow x 2, brush x 2, blow x 2, brush x 2, blow x 2. For diamond drilling technique refer to **ETA-25/0648.**
3. Screw mixing nozzle onto cartridge and dispense adhesive to waste until colour is orange. Insert mixing nozzle to bottom of hole.
   Fill hole to 2/3 the hole depth slowly, ensuring no air pockets form.
4. Insert **Ramset™** ChemSet™ Anchor Stud/rebar to bottom of hole while turning.
5. Allow Chemset™ EPCON™ G5 Xtrem™ to cure as per setting times.
6. Attach fixture.

Setting Times

Temperature of base material	Gel Time	Curing time in dry concrete	Curing time in wet and flooded concrete
5°C	75 min	30h	60 h
10°C	45 min	22h	44 h
15°C	35 min	14h	28 h
20°C	22 min	7h	14 h
25°C	14 min	5h	10 h
30°C	8 min	4h	8 h
35°C	6 min	3h	6h
40°C	4 min	2h 45min	5h 30min

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Installation and performance details: ChemSet™ EPCON™ G5 Xtrem™ and ChemSet™ Anchor Studs

Anchor size, d_b (mm)	Drilled hole diameter, d_h (mm)	Fixture hole diameter, d_f (mm)	Anchor effective depth, h_n (mm)	Tightening torque, T_r (Nm)	Optimum dimensions*		Concrete substrate thickness, b_m (mm)	Seismic C1 & C2 Cracked Concrete reduced characteristic tensile capacity, $N_{Rd,seis}$ (kN) **					
					Anchor* spacing, a_c (mm)	Edge* distance, e_c (mm)		Concrete Compressive Strength, f'_c					
								20 MPa		30 MPa		40 MPa	
								C1	C2	C1	C2	C1	C2
M10	12	12	90	20	270	135	120	9.9	6.4	9.9	6.4	9.9	6.4
M12	14	14	110	30	330	165	140	19.9	12.2	20.2	12.2	20.2	12.2
M16	18	18	125	60	375	188	161	24.1	14.6	29.5	14.6	33.1	14.6
M20	25	22	170	120	510	255	214	38.2	23.0	46.7	23.0	54.0	23.0
M24	28	26	210	150	630	315	262	52.4	26.0	64.2	26.0	74.1	26.0
M30	35	33	280	180	840	420	350	80.7	71.8	98.8	71.8	114.1	71.8

All data relevant for Dry and Wet Holes. For Flooded Holes MULTIPLY $N_{Rd,\ seis}$ x 0.62

* For anchor spacings or edge distances less than the minimum, please refer to the simplified strength limit state design process to verify capacity.

** Tension values are based on service temperature limits -40°C to +40°C only. If service temperature limits is beyond this range please contact Ramset Engineer.

** Note: Seismic Cracked concrete combined pull-out and concrete cone resistance, tension = $N^0_{Rd,p,seis} = \alpha_{Nseis}\ N^0_{Rk,p,seis} / \gamma_{Msp}$ where $\gamma_{Msp} = 1.5$

Anchor size, d_b (mm)	Reduced Characteristic Capacity											
	Grade 5.8 Steel Studs			Grade 8.8 Steel Studs			ANSI 316 Stainless Steel Studs			HCR 1.4529 Stainless Steel Studs		
	Shear, $V_{Rd,s,seis}$ (kN)#		Tension, $N_{Rd,s,seis}$(kN)***	Shear, $V_{Rd,s,seis}$ (kN)#		Tension, $N_{Rd,s,seis}$(kN)***	Shear, $V_{Rd,s,seis}$ (kN)#		Tension, $N_{Rd,s,seis}$(kN)***	Shear, $V_{Rd,s,seis}$ (kN)#		Tension, $N_{Rd,s,seis}$(kN)***
	C1	C2	C1 & C2	C1	C2	C1 & C2	C1	C2	C1 & C2	C1	C2	C1 & C2
M10	3.5	3.9	19.3	5.5	6.3	30.9	3.9	4.4	21.7	4.8	5.5	27.1
M12	6.0	6.1	28.1	9.6	9.8	44.9	6.8	6.8	31.6	8.4	8.5	39.3
M16	10.9	10.7	52.3	17.5	17.1	83.7	12.3	12.0	58.8	15.3	15.0	73.3
M20	17.1	16.7	81.7	27.3	26.7	130.7	19.2	18.7	91.7	23.9	23.4	114.3
M24	18.9	17.8	117.7	30.3	28.5	188.3	21.2	20.0	132.1	26.5	25.0	164.7
M30	30.1	30.1	187.0	48.1	45.8	299.2	33.7	32.1	210.0	42.1	40.1	261.8

***Note: Seismic Cracked Concrete steel resistance, tension = $N_{Rd,s,seis} = \alpha_{Nseis}\ N^0_{Rk,s,seis} / \gamma_{Ms}$ (kN) where $\gamma_{Ms} = 1.5$ (Grade 5.8 & 8.8 steel), $\gamma_{Ms} = 1.87$ (A4 316 SS) and $\gamma_{Ms} = 1.5$ (HCR 1.4529 stainless steel)

 # Note: Shear Data includes annular gap reduction factor of 0.5

For optimised performance data, including performance based on diamond drilling technique, please use Ramset iExpert Anchoring Software.

DESCRIPTION AND PART NUMBERS

Description	Cartridge Size	Part No.
ChemSet™ EPCON™ G5 Xtrem™	600ml	CEG5X600

ENGINEERING PROPERTIES ChemSet™ Anchor Studs and Threaded Rod

Anchor Size, d_b	Grade 8.8 Threaded Rod				Stainless Steel High Corrosion Resistance HCR Grade 1.4529/1.4565 Threaded Rod				Section modulus Z (mm^3)
	Shank diameter, d_s (mm)	Stressed Area (mm^2)	Yield Strength f_y MPa	UTS f_u MPa	Shank diameter, d_s (mm)	Stressed Area (mm^2)	Yield Strength f_y MPa	UTS f_u MPa	
M10	8.6	58	640	800	8.2	52.8	450	650	62.3
M12	10.4	84.3	640	800	10	78.5	450	650	109.2
M16	14.1	157	640	800	14	153.9	450	650	277.5
M20	17.7	245	640	800	17.2	232.4	450	650	540.9
M24	21.2	353	640	800	20.7	336.5	450	650	935.5
M30	26.7	561	640	800	-	-	-	-	-

Refer to "Engineering Properties" for ChemSet™ Anchor Studs Grade 5.8 and AISI 316 Stainless Steel in the SARB ANZ.

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STRENGTH LIMIT STATE DESIGN

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STEP 1 Select anchor to be evaluated

Table 1a Indicative combined loading – interaction diagram

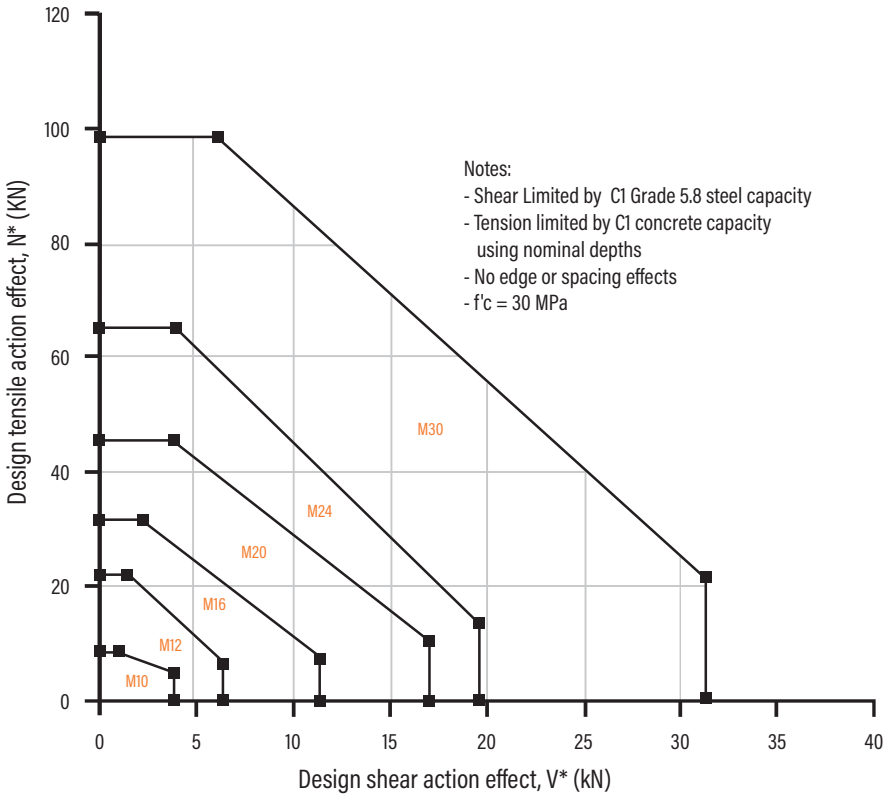

Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

Anchor size, d_b	M10	M12	M16	M20	M24	M30
Min. Anchor Spacing - a_m	40	50	70	85	90	140
Min. Edge Distance - e_m	40	40	45	55	60	90

Step 1c Calculate anchor effective depth, h (mm)

Refer to "Description and Part Numbers" table for ChemSet™ Anchor Studs page in the SARB ANZ.

Effective depth, h (mm)

Preferred h = h_n otherwise,

$$h = L_e - t$$

t = total thickness of material(s) being fastened.

Substrate thickness b_m (mm)		
Anchor Stud Size (mm)		
M10	M12	M16 to M30
h + 30mm ≥ 100mm		h + (2 x d_h)

Checkpoint 1

Anchor size determined, absolute minima compliance achieved, effective depth (h) calculated.

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STRENGTH LIMIT STATE DESIGN

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STEP 2 Verify Seismic C1 & C2 cracked concrete tensile capacity - per anchor

Table 2a - Seismic C1 & C2 Cracked concrete combinded Pull-out and concrete cone resistance, tension

$N^0_{Rd,p,seis} = \alpha_{seis} N^0_{Rk,p,seis} / \gamma_{Msp}$ (kN), $\alpha_{N,seis} = 0.85$, $\gamma_{Msp} = 1.5$, f'c = 30 MPa where $N^0_{Rk,p,seis} = \pi * d_b * h * \tau_{Rk,cr,seis}$

Anchor Size, d_b	C1 & C2 Seismic Data combinded pull-out and concrete cone resistance $N^0_{Rd,p,seis}$												Concrete Cone Resistance - $N^0_{Rd,c,seis}$
	M10		M12		M16		M20		M24		M30		
Drilled Hole Dia, d_h (mm)	12		14		18		25		28		35		
Effective Depth, h (mm)	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	
70	7.7	5.0											12.4
80	8.8	5.7											15.1
90	**9.9**	**6.4**	16.5	10.0									18.0
100	11.0	7.1	18.4	11.1									21.1
110	12.1	7.8	**20.2**	**12.2**	29.1	12.8							24.3
120	13.2	8.5	22.0	13.3	31.8	14.0							27.7
125	13.8	8.9	23.0	13.9	**33.1**	**14.6**							29.5
140	15.5	10.0	25.7	15.6	37.1	16.3							34.9
150	16.6	10.7	27.6	16.7	39.7	17.5	49.1	20.3					38.7
160	17.7	11.4	29.4	17.8	42.4	18.7	52.4	21.6	64.9	19.8			42.7
170	18.8	12.1	31.2	18.9	45.0	19.9	**55.7**	**23.0**	69.0	21.1			46.7
180	19.9	12.8	33.1	20.0	47.7	21.0	59.0	24.4	73.1	22.3			50.9
190	21.0	13.5	34.9	21.1	50.3	22.2	62.2	25.7	77.1	23.5			55.2
200	22.1	14.2	36.7	22.2	53.0	23.4	65.5	27.1	81.2	24.8			59.6
210			38.6	23.3	55.6	24.5	68.8	28.4	**85.2**	**26.0**	93.1	53.8	64.2
240			44.1	26.7	63.6	28.0	78.6	32.5	97.4	29.7	106.4	61.5	78.4
280					74.2	32.7	91.7	37.9	113.7	34.7	**124.1**	**71.8**	98.8
320					84.8	37.4	104.8	43.3	129.9	39.6	141.8	82.0	120.7
350							114.6	47.4	142.1	43.4	155.1	89.7	138.1
400							131.0	54.1	162.4	49.6	177.3	102.5	168.7
450									182.7	55.8	199.5	115.4	201.3
480									194.8	59.5	212.8	123.0	221.8
550											243.8	141.0	272.0
600											266.0	153.8	309.9

Bold values are at ChemSet Anchors Stud nominal depths h_n

All data relevant for Dry and Wet Holes. For Flooded Holes MULTIPLY $N^0_{Rd,p,seis}$ x 0.62 & $N^0_{Rd,c,seis}$ x 0.62. For single anchor values: Multiply $N^0_{Rd,p,seis}$ *1.17 & $N^0_{Rd,c,seis}$ x 1.13. For optimised performance data, including performance based on diamond drilling technique, please use Ramset iExpert Anchoring Software.

For C1 Seismic - Calculate $N_{Rd,p,seis}$, $N_{Rd,c,seis}$ then choose minimum - Refer to Checkpoint 2a and 2b
For C2 Seismic - Calculate $N_{Rd,p,seis}$ only then choose minimum - Refer to Checkpoint 2a only

Table 2b-1 Seismic Cracked concrete service temperature limits effect, tension, X_{ns}

Service temperature (˚C)	Seis. Cat.	M10	M12	M16	M20	M24	M30
-40˚C to +40˚C	C1	1.00	1.00	1.00	1.00	1.00	1.00
	C2	1.00	1.00	1.00	1.00	1.00	1.00
-40˚C to +60˚C	C1	0.85	0.85	0.84	0.85	0.84	0.85
	C2	0.85	0.85	0.85	0.84	0.85	0.83
-40˚C to +75˚C	C1	0.26	0.27	0.26	0.26	0.26	0.26
	C2	0.25	0.27	0.27	0.26	0.26	0.25

Table 2b-2 Seismic Cracked concrete compressive strength effect, tension, X_{nc}

f'c (MPa)	20	25	30	40	50
X_{nc} for $N^0_{Rd,p,seis}$ (Bond)	1.0	1.0	1.0	1.0	1.0
X_{nc} for $N^0_{Rd,c,seis}$ (Conc.)	0.81	0.91	1.0	1.15	1.29

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STRENGTH LIMIT STATE DESIGN

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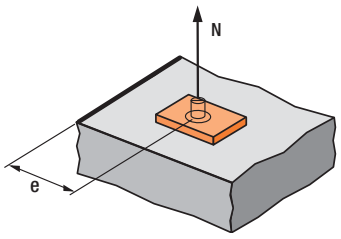
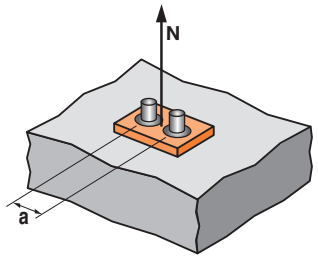


$X_{ne} = 0.25 + 0.5*(e/h)$
Where $e_m \le e \le e_c$
$e_c = 1.5*h$
Note: Tabled values are based on the nominal effective depth, h shown in the installation details. For other values of X_{ne}, please use equation shown above.

Table 2c - Seismic cracked concrete Edge distance effect, tension, X_{ne}

Anchor size, db	M10	M12	M16	M20	M24	M30
Edge distance, e (mm)						
40	0.47	0.43				
45	0.50	0.45	0.43			
50	0.53	0.48	0.45			
55	0.56	0.50	0.47	0.41		
60	0.58	0.52	0.49	0.43	0.39	
65	0.61	0.55	0.51	0.44	0.40	
70	0.64	0.57	0.53	0.46	0.42	
90	0.75	0.66	0.61	0.51	0.46	0.41
100	0.81	0.70	0.65	0.54	0.49	0.43
115	0.89	0.77	0.71	0.59	0.52	0.46
135	1.00	0.86	0.79	0.65	0.57	0.49
165		1.00	0.91	0.74	0.64	0.54
187			1.00	0.80	0.70	0.58
255				1.00	0.86	0.71
315					1.00	0.81
420						1.00



$X_{na} = 0.5 + a/(6*h)$
Where $a_m \le a \le a_c$
$a_c = 3*h$
Note: Tabled values are based on the nominal effective depth, h shown in the installation details. For other values X_{na}, please use equation shown above.

Table 2d - Seismic cracked concrete anchor spacing effect, tension, X_{na}

Anchor size, d_b	M10	M12	M16	M20	M24	M30
Anchor spacing, a (mm)						
40	0.57					
45	0.58					
50	0.59	0.58				
55	0.60	0.58				
60	0.61	0.59				
70	0.63	0.61	0.59			
80	0.66	0.63	0.61	0.58		
90	0.67	0.64	0.62	0.59	0.57	
140	0.76	0.71	0.69	0.64	0.61	0.58
170	0.81	0.76	0.73	0.67	0.63	0.60
200	0.87	0.80	0.77	0.70	0.66	0.62
270	1.00	0.91	0.86	0.76	0.71	0.66
330		1.00	0.94	0.82	0.76	0.70
375			1.00	0.87	0.80	0.72
510				1.00	0.90	0.80
630					1.00	0.88
840						1.00

Checkpoint 2a

Design seismic cracked concrete combined pull-out and concrete cone resistance, $N_{Rd,p,seis}$
$N_{Rd,p,seis} = N^0_{Rd,p,seis} * X_{ns} * X_{nc} * X_{ne} * X_{na}$

Checkpoint 2b

Design seismic cracked concrete combined pull-out and concrete cone resistance, $N_{Rd,c,seis}$
$N_{Rd,c,seis} = N^0_{Rd,c,seis} * X_{ns} * X_{nc} * X_{ne} * X_{na}$

STEP 3

Verify seismic C1 & C2 cracked concrete tensile resistance - per anchor

Table 3a - Seismic (C1 & C2) Cracked Concrete steel resistance, tensile, $N_{Rd,s,seis} = \alpha_{seis} N_{Rk,s,seis}/\gamma_{Ms}$ (kN), $\alpha_{seis} = 1.0$
$\gamma_{Ms} = 1.5$ for Grade 5.8 and Grade 8.8 Carbon Steel
$\gamma_{Ms} = 1.87$ for A4 316 Stainless Steel
$\gamma_{Ms} = 1.5$ for HCR 1.4529 Stainless Steel

Anchor size, d_b	M10	M12	M16	M20	M24	M30
Grade 5.8 Carbon Steel	19.3	28.1	52.3	81.7	117.7	187.0
Grade 8.8 Carbon Steel	30.9	44.9	83.7	130.7	188.3	299.2
A4 316 Stainless Steel	21.7	31.6	58.8	91.7	132.1	210.0
HCR 1.4529 Stainless Steel	27.1	39.3	73.3	114.3	164.7	261.8

Checkpoint 3

Design seismic C1 & C2 cracked concrete tensile resistance, $N_{Rd,seis}$
$N_{Rd,seis}$ = minimum of $N_{Rd,p,seis}$, $N_{Rd,c,seis}$, $N_{Rd,s,seis}$
Check $N^*/N_{Rd,seis} \le 1$,
if not satisfied return to step 1

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STEP 4

Step 4 - Verify seismic C1 & C2 cracked concrete edge shear resistance - per anchor

Table 4a - Seismic C1 & C2 cracked concrete edge resistance, $V^0_{Rd,c,seis} = \alpha_{seis} V^0_{Rk,c,seis} / \gamma_{Mc}$ (kN), γ_{Mc} = 1.5, α_{seis} = 0.85, f'_c = 30 MPa

Anchor size, d_b	M10	M12	M16	M20	M24	M30
Effective depth, h (mm)	90	110	125	170	210	280
Edge distance, e_m						
40	1.3	1.5				
45			1.9			
55				2.8		
60					3.5	
90						6.5

Note: Data includes annular gap reduction factor of 0.5. If annular gap is filled multiply $V_{Rd,c,seis}$*2

For single anchor values: Multiply $V^0_{Rd,c,seis}$ * 1.17

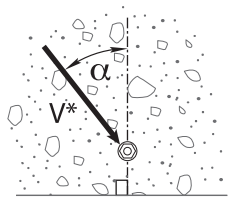
For optimised performance data, please use Ramset iExpert Anchoring Software.

Table 4b - Seismic cracked concrete compressive strength effect, shear, X_{vc}

f'c (MPa)	20	25	30	40	50
X_{vc}	0.82	0.91	1.00	1.15	1.29

Table 4c - Seismic cracked concrete load direction effect, concrete edge shear, X_{vd}

Angle, α°	0-55	60	70	80	90-180
X_{vd}	1	1.1	1.2	1.5	2



Load direction effect, conc. edge shear, X_{vd}

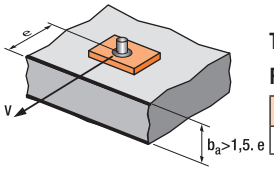
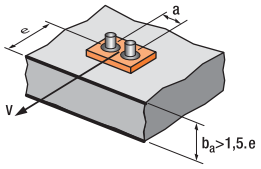


Table 4d - Seismic cracked concrete anchor spacing and edge distance effect, concrete edge shear, X_{ve}

For single anchor fastening X_{ve}

e/e_m	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
X_{ve}	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72

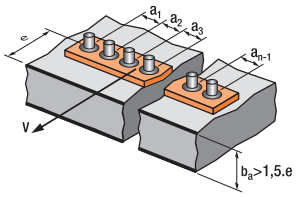
$$X_{ve} = e/e_m * \sqrt{e/e_m}$$



$$X_{ve} = \frac{3*e+a}{6*e_m} * \sqrt{e/e_m}$$

For 2 anchors fastening X_{ve}

e/e_m	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
a/e_m												
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

$$X_{ve} = \frac{3*e + a_1 + a_2 + a_3 + \ldots + a_{n-1}}{3*n*e_m} * \sqrt{e/e_m}$$

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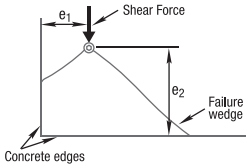
Table 4e - Seismic C1 & C2 Cracked concrete Pryout failure, $V^0_{Rd,cp,seis} = \alpha_{seis} V_{Rk,cp} / \gamma_{Mpr}$ (kN), γ_{Mpr} = 1.5, α_{seis} = 0.75, f'_c = 30 MPa

Anchor size, d_b		M10	M12	M16	M20	M24	M30
Effective depth, h (mm)		90	110	125	170	210	280
-40˚C to +40˚C	C1 Seismic Data	8.8	17.8	29.2	46.7	64.2	98.8
	C2 Seismic Data	5.7	10.8	12.9	20.3	23.0	63.3
-40˚C to +60˚C	C1 Seismic Data	7.5	15.1	24.5	39.6	54.0	83.9
	C2 Seismic Data	4.8	9.1	11.0	17.1	19.6	52.8
-40˚C to +75˚C	C1 Seismic Data	2.3	4.8	7.5	12.2	16.6	25.7
	C2 Seismic Data	1.4	2.9	3.5	5.3	6.0	15.8

Note: Data includes annular gap reduction factor of 0.5 For single anchor values: Multiply $V^0_{Rd,cp,seis}$ *1.13
If annular gap is filled multiply $V_{Rd,cp,seis}$ *2

Table 4f Anchor at a corner effect, concrete edge shear, X_{VS}

Note: For $e_1/e_2 > 1.25$, $X_{VS} = 1.0$



ANCHOR AT A CORNER

Edge distance, e_2 (mm)	25	30	35	50	60	75	125	200	300	400	600	900
Edge distance, e_1 (mm)												
25	0.86	0.77	0.70	0.58	0.53	0.49	0.41	0.37	0.35	0.34	0.32	0.32
30	0.97	0.86	0.78	0.64	0.58	0.52	0.43	0.38	0.36	0.34	0.33	0.32
35	1.00	0.95	0.86	0.69	0.63	0.56	0.46	0.40	0.37	0.35	0.33	0.32
50	1.00	1.00	1.00	0.86	0.77	0.67	0.52	0.44	0.39	0.37	0.35	0.33
60	1.00	1.00	1.00	0.97	0.86	0.75	0.57	0.47	0.41	0.38	0.36	0.34
75	1.00	1.00	1.00	1.00	1.00	0.86	0.64	0.51	0.44	0.41	0.37	0.35
125	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.65	0.53	0.48	0.42	0.38
200	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.67	0.58	0.49	0.42
300	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.72	0.58	0.49
400	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.67	0.55
500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.77	0.61
600	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.67
900	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86

Checkpoint 4a

Design seismic cracked concrete edge shear resistance, $V_{Rd,c,seis}$
$= V^0_{Rd,c,seis} * X_{vc} * X_{vd} * X_{ve} * X_{vs}$

Checkpoint 4b

Design seismic cracked concrete Pryout failure,
$V_{Rd,cp,seis} = V^0_{Rd,cp,seis} * X_{nc} * X_{ne} * X_{na}$

STEP 5

Verify seismic C1 & C2 cracked concrete shear resistance - per anchor

Table 5a - Seismic C1 & C2 Cracked Concrete steel shear resistance, $V_{Rd,s,seis} = \alpha_{seis} V_{Rk,s,seis} / \gamma_{Ms}$ (kN), α_{seis} = 0.85

γ_{Ms} = 1.25 for Grade 5.8 and Grade 8.8 Carbon Steel

γ_{Ms} = 1.56 for A4 316 Stainless Steel

Anchor size, db	M10		M12		M16		M20		M24		M30	
Seismic Category	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2
Grade 5.8 Carbon Steel	3.5	3.9	6.0	6.1	10.9	10.7	17.1	16.7	18.9	17.8	30.1	30.1
Grade 8.8 Carbon Steel	5.5	6.3	9.6	9.8	17.5	17.1	27.3	26.7	30.3	28.5	48.1	45.8
A4 316 Stainless Steel	3.9	4.4	6.8	6.8	12.3	12.0	19.2	18.7	21.2	20.0	33.7	32.1
HCR 1.4529 Stainless Steel	4.8	5.5	8.4	8.5	15.3	15.0	23.9	23.4	26.5	25.0	42.1	40.1

Note: Data includes annular gap reduction factor of 0.5 If annular gap is filled multiply $V_{Rd,s,seis}$*2
For single anchor values: Multiply $V_{Rd,s,seis}$*1.17

Checkpoint 5

Design seismic C1 & C2 cracked concrete shear resistance, $V_{Rd,\ seis}$
$V_{Rd,\ seis}$ = minimum of $V_{Rd,c,\ seis}$, $V_{Rd,cp,\ seis}$,$V_{Rd,s,\ seis}$
Check $V^*/V_{Rd,\ seis} \leq 1$,
if not satisfied return to step 1

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STEP 6 Combined Loading

Checkpoint 6

Check
$N^*/N_{Rd,seis} + V^*/V_{Rd,seis} \leq 1.0$,
if not satisfied return to step 1

Specifiy - Threaded Stud Anchors
Ramset™ EPCON™ G5 Xtrem™ with (Anchor Size) grade 5.8 ChemSet™ Anchor Stud (Anchor Stud Part Number) Drilled Hole Depth to be (h) mm.

Example
Ramset™ EPCON™ G5 Xtrem™ Injection with M16 grade 5.8 ChemSet™ Anchor Stud (CS16190GH). Drilled hole depth to be 125mm. To be installed according to Ramset™ Installation Instructions.

Use Ramset™ iExpert Anchor Software for optimised calculation or where a greater range of anchor layout detail is needed.