ChemSet™ 801 Xtrem™ XC²

SEISMIC REINFORCING BAR - CHEMICAL INJECTION

GENERAL INFORMATION

Performance Related	Installation Related

Product

ChemSet™ 801 Xtrem™ XC² is a heavy duty Vinylester adhesive for anchoring threaded studs and reinforcing bar into cracked and uncracked concrete.

Compliance

European Technical Assessment (option 1) - ETA-18/0045

Design according to:

- AS5216 (formerly TS101)
- AS1170.4 - Earthquake Actions
- EN1992-4 (formerly ETAG001 Annex C, E & TR045)
- NZS3101 (A3) Section 17 - Seismic Design C1
- 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

- 50 year working life

Greater productivity:

- Easy dispensing even in cold weather
- Apply torque in 2 hours @ 20°C

Greater security:

- Strong bond
- Rated for sustained loading

Versatile:

- Earthquake, Fire & Flooded Conditions
- Cold and temperate climates

Greater safety:

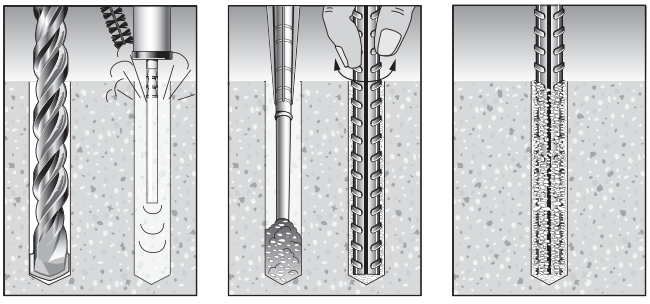
- Low odour
- Suitable for contact with drinking water
- VOC Compliant

Made in Australia

Principal Applications

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

Installation



1. Drill or core hole to specified diameter and depth
2. **Important:** Use **Ramset™** Dustless Drilling System to ensure holes are clean. Alternatively, clean dust and debris from hole with stiff wire or nylon brush and blower in the following sequence: blow x 2, brush x 2, blow x 2.
3. Screw mixing nozzle onto cartridge and dispense 2-3 trigger pulls of adhesive to waste until colour is grey with no streaks
4. Insert tip of nozzle to bottom of hole and dispense adhesive
5. Fill hole to about 2/3 full
6. Insert reinforcing bar with rotating motion to release trapped air
7. Wait until adhesive has fully cured before loading (see Working Time / Loading Time chart)
8. Clean up with Acetone

Recommended Installation Temperatures

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

Service Temperature Limits

-40°C to 80°C

Setting Times

Temperature of base material	Gel Time	Curing time in dry concrete	Curing time in wet concrete
+5°C	60 min	240 min	480 min
6°C - 10°C	40 min	180 min	360 min
11°C - 20°C	15 min	120 min	240 min
21°C - 30°C	8 min	90 min	180 min
31°C - 40°C	4 min	60 min	120 min
Note: Cartridge temperature minimum +5°C			

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Installation and performance details: Chemset™ 801 Xtrem™ XC² and Reinforcing Bar

Anchor Size, d_b (mm)	Drilled Hole diam., d_h (mm)	Anchor Effective Depth, h (mm)	Optimum dimensions*		Concrete substrate thickness, b_m (mm)	Gr 500 Rebar - Steel		Seismic C1 Cracked Concrete reduced characteristic tensile capacity, $N^0_{Rd,p,seis}$ (kN) **
			Edge* distance, e_c (mm)	Anchor* spacing, a_c (mm)		Tension, $N_{Rd,s,seis}$ (kN)***	Shear, $\phi V_{Rd,s,seis}$ (kN)	Concrete compressive strength, f'_c
								20 to 50 MPa
10	12	90	270	135	120	30.7	10.1	6.1
12	15	110	330	165	140	44.2	14.5	12.9
16	20	125	375	187	160	78.7	25.8	19.6
20	25	170	510	255	220	122.9	40.4	36.3

** 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 = $N^0_{Rd,p,seis} = \alpha_{N'seis}\ N^0_{Rk,p,seis} / \gamma_{Msp}$ where $\gamma_{Msp} = 1.5$, $\alpha_{Nseis} = 0.85$

*** Note: Seismic Cracked Concrete steel resistance, tension = $N_{Rd,s,seis} = \alpha_{Nseis}\ N^0_{Rk,s,seis} / \gamma_{Ms}$ (kN) where $\gamma_{Ms} = 1.38$

Flooded Holes: Multiply $N^0_{Rd,p,seis}$ *0.9

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

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

DESCRIPTION AND PART NUMBERS

Description	Cartridge Size	Part No.
ChemSet™ 801 Xtrem™ XC²	750ml	C801X750 (AU & NZ)
ChemSet™ 801 Xtrem™ XC²	380ml	C801X380 (AU Only)

Drilled hole depth, h1 (mm)
h1 = h
h = Effective depth

Substrate thickness, b_m (mm)			
Reinforcing Bar Size			
10	12	16	20
h + 30mm ≥ 100mm		h + (2 x d_h)	

ENGINEERING PROPERTIES

Typical Engineering Properties of Grade 500 Reinforcing Bar

Rebar Size	10	12	16	20
Drilled Hole Dia, d_h (mm)	**12**	**15**	**20**	**25**
Stress Area, A_s (mm^2)	78.5	113	201	314
Yield Stress, f_{sy} (MPa)	500	500	500	500
Tensile Steel Yield Capacity, N_{sy} (kN)	39.3	56.5	100.5	157.0

For further information refer to reinforcing bar manufacturer's published information and current revision of **AS/NZS4671**

ChemSet™ 801 Xtrem™ XC²

STRENGTH LIMIT STATE DESIGN

STEP 1 Select anchor to be evaluated

Table 1a Indicative combined loading - interaction diagram

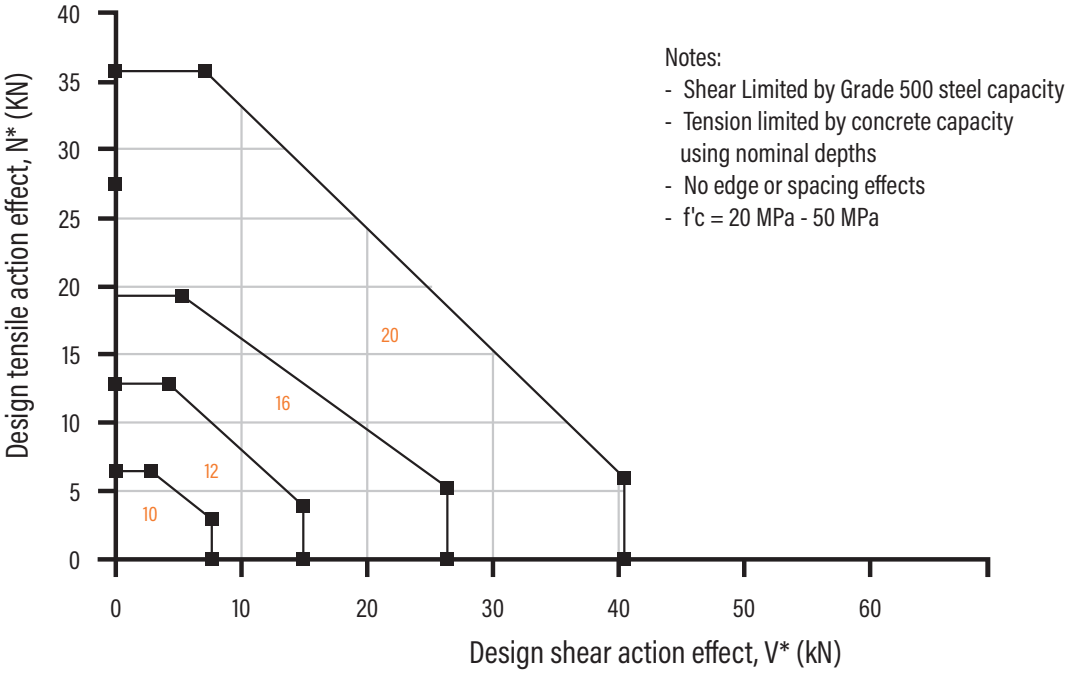

Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

Anchor size, d_b	10	12	16	20
Min. Anchor Spacing - a_m	50	60	80	100
Min. Edge Distance - e_m	45	45	50	65

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

Refer to nominal recommended effective depths, h, listed in installation and performance details in the SARB ANZ on the previous page.

Substrate thickness, b_m (mm)			
Reinforcing Bar Size			
10	12	16	20
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

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

Table 2a - Seismic 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), $\gamma_{Msp} = 1.5$, $\alpha_{N,seis} = 0.85$, $f'_c = 30$ MPa

where $N^0_{Rk,p,seis} = \pi * d_b * h * \tau_{Rk,cr,seis}$

Anchor Size, d_b	10	12	16	20
Drilled Hole Dia, d_h (mm)	12	15	20	25
Effective Depth, h (mm)				
70	4.7			
80	5.4			
90	**6.1**	10.6		
100	6.8	11.7		
110	7.4	**12.9**	17.2	
120	8.1	14.1	18.8	
125	8.5	14.7	**19.6**	
140	9.5	16.4	21.9	
150	10.1	17.6	23.5	32.0
160	10.8	18.8	25.1	34.2
170	11.5	20.0	26.6	**36.3**
180	12.2	21.1	28.2	38.5
190	12.9	22.3	29.8	40.6
200	13.5	23.5	31.3	42.7
210		24.7	32.9	44.9
240		28.2	37.6	51.3
280			43.9	59.8
320			50.1	68.4
350				74.8
400				85.5

Bold values are at ChemSet Rebar Anchor nominal depths

Note: The maximum embedment depth shall be reduced to $12d_b$ for installation in flooded holes

Flooded Holes: Multiply $N^0_{Rd,p,seis}$ *0.9

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

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

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

	Service temperature limits effect, tension, X_{ns}			
Anchor size, d_b	M10	M12	M16	M20
Service temperature (˚C)				
-40˚C to +40˚C	1.00	1.00	1.00	1.00
-40˚C to +80˚C	1.00	1.00	1.00	1.00

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

f'c (MPa)	20	25	30	40	50
X_{nc}	1.0	1.0	1.0	1.0	1.0

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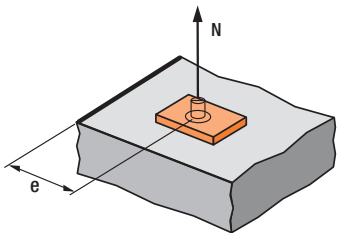
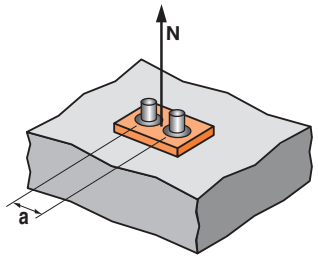
STRENGTH LIMIT STATE DESIGN



$X_{ne} = 0.25 + 0.5*(e/h)$
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, d_b	10	12	16	20
Edge distance, e (mm)				
45	0.50	0.45		
50	0.53	0.48	0.45	
65	0.61	0.55	0.51	0.44
85	0.72	0.64	0.59	0.50
90	0.75	0.66	0.61	0.51
100	0.81	0.70	0.65	0.54
120	0.92	0.80	0.73	0.60
135	1	0.86	0.79	0.65
165		1	0.91	0.74
187			1	0.80
255				1



$X_{na} = 0.5 + a/(6*h)$
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	10	12	16	20
Anchor spacing, a (mm)				
50	0.59			
60	0.61	0.59		
80	0.65	0.62	0.61	
100	0.69	0.65	0.63	0.60
120	0.72	0.68	0.66	0.62
150	0.78	0.73	0.70	0.65
200	0.87	0.80	0.77	0.70
270	1	0.91	0.86	0.76
330		1	0.94	0.82
375			1	0.87
510				1

Checkpoint 2

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

STEP 3

Verify seismic C1 cracked concrete tensile resistance - per anchor

Table 3a - Seismic Cracked Concrete steel resistance, tensile, $N_{Rd,s,seis} = \alpha_{seis} N_{Rk,s,seis}/\gamma_{Ms}$ (kN)
where $\alpha_{seis} = 1.0$, $\gamma_{Ms} = 1.38$ for Grade 500 Rebar

Anchor size, d_b	10	12	16	20
Grade 500 Rebar	30.7	44.2	78.7	122.9

Checkpoint 3

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

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STRENGTH LIMIT STATE DESIGN

STEP 4

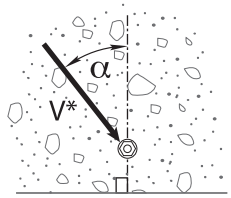
Step 4 - Verify seismic C1 cracked concrete edge shear resistance - per anchor

Table 4a - Seismic cracked concrete edge resistance, $V^0_{Rd,c,seis} = \alpha_{seis} V^0_{Rk,c,seis} / \gamma_{Mc}$ (kN)

Where γ_{Mc} = 1.5, α_{seis} = 0.85, f'_c = 30 MPa

Anchor size, d_b	10	12	16	20
Effective depth, h (mm)	90	110	125	170
Edge distance, e_m				
45	3.1	3.4		
50			4.2	
65				6.7

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



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

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

f'_c (MPa)	20	25	30	40	50
X_{vc}	0.82	0.90	1	1.16	1.27

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

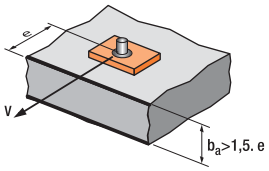
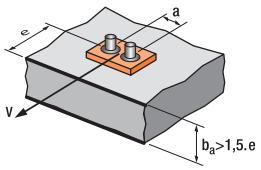


Table 4d - Seismic cracked concrete anchor spacing and edge distance effect, concrete edge shear, X_{ve}

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

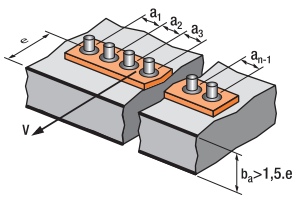
$$X_{ve} = e/e_m * \sqrt{e/e_m}$$



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

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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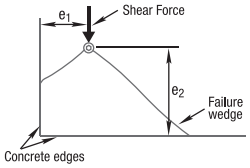
STRENGTH LIMIT STATE DESIGN

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

Anchor size, d_b	10	12	16	20
Effective depth, h (mm)	90	110	125	170
-40˚C to +40˚C	10.7	28.8	34.6	64.1
-40˚C to +80˚C	10.7	28.8	34.6	64.1

For single anchor values: Multiply $V^0_{Rd,cp,seis}$*1.13



ANCHOR AT A CORNER

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

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

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 cracked concrete shear resistance - per anchor

Table 5a - Seismic Cracked Concrete steel shear resistance, $V_{Rd,s,seis} = \alpha_{seis} V_{Rk,s,seis} / \gamma_{Ms}$ (kN)
where α_{seis} = 0.85 and γ_{Ms} = 1.25

Anchor size, d_b	10	12	16	20
Gr 500 Rebar	10.1	14.5	25.8	40.4

For single anchor values: Multiply $V_{Rd,s,seis}$*1.17

Checkpoint 5

Design seismic C1 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

ChemSet™ 801 Xtrem™ XC²

STRENGTH LIMIT STATE DESIGN

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
Ramset™ 801 Xtrem™ XC² Injection
(Anchor Size) grade 500 rebar
Drilled Hole Depth to be (h) mm.

Example
Ramset™ 801 Xtrem™ XC² Injection with
20mm grade 500 rebar
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.