ChemSet™ EPCON™ G5 Xtrem™

CHEMICAL INJECTION - NON-CRACKED & CRACKED CONCRETE

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

GENERAL INFORMATION

Performance Related	Material Specification	Installation Related

Product

Chemset™ 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:

- EN 1992-4 (formerly ETAG001 Annex C, E & TR045)
- 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

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

Installation and Substrate Temperatures Range

Minimum	Maximum
5°C	40°C

For correct installation, make sure to use only genuine Ramset tools

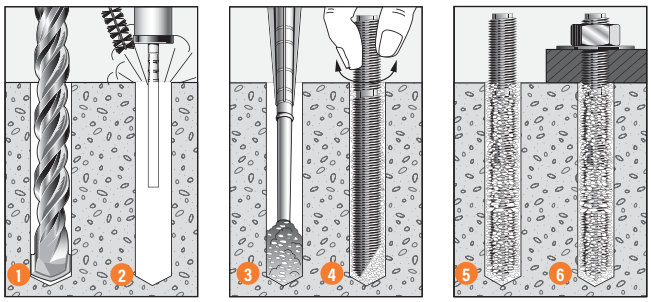
Service Temperature Limits

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

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

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.

ChemSet™ EPCON™ G5 Xtrem™

CHEMICAL INJECTION - NON-CRACKED & CRACKED CONCRETE

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

Anchor size, d_b (mm)	Installation Details				Optimum dimensions*		
	Drilled hole diameter, d_h (mm)	Fixture hole diameter, d_f (mm)	Anchor effective depth, h (mm)	Tightening torque, T_r (Nm)	Edge distance, e_c (mm)	Anchor spacing, a_c (mm)	Concrete substrate thickness, b_m (mm)
M10	12	12	90	20	135	270	120
M12	14	14	110	30	165	330	140
M16	18	18	125	60	187.5	375	160
M20	25	22	150	120	225	450	190
			170		255	510	220
M24	28	26	160	150	240	480	200
			210		315	630	270
M30	35	33	280	180	420	840	350

* Note: For shear loads acting towards an edge or where these optimum dimensions are not achievable, please use the simplified strength limit state design process to verify capacity.

Anchor size, d_b (mm)	Recommended Capacity# (FOS = 3)								
	Grade 5.8 Steel Studs		Grade 8.8 Steel Studs		A4 316 Stainless Steel Studs		Non-Cracked Concrete		
							Tension, ϕN_{uc} (kN)**		
	Shear, ϕV_{us} (kN)	Tension, ϕN_{us} (kN)***	Shear, ϕV_{us} (kN)	Tension, ϕN_{us} (kN)***	Shear, ϕV_{us} (kN)	Tension, ϕN_{us} (kN)***	Concrete Compressive Strength, f'_{cc}		
							25 N/mm2	40 N/mm2	50 N/mm2
M10	4.8	9.7	7.7	15.5	6.8	13.5	14.0	17.7	19.8
M12	7.0	14.1	11.2	22.5	9.8	19.7	18.9	23.9	26.8
M16	13.1	26.2	20.9	41.9	18.3	36.6	22.9	29.0	32.4
M20	20.4	40.8	32.7	65.3	28.6	57.2	30.1	38.1	42.6
							36.3	46.0	51.4
M24	29.4	58.8	47.1	94.1	41.2	82.4	33.2	42.0	46.9
							49.9	63.1	70.6
M30	46.8	93.5	74.8	149.6	65.5	130.9	76.8	97.2	108.7

**Note: Recommended concrete tensile capacity = ϕN_{uc} and N_{uc} = Characteristic ultimate concrete tensile capacity. For value of ϕ = 3 on the above table

***Note: Recommended steel tensile capacity = ϕN_{us} where ϕ = 3 and N_{us} = Characteristic ultimate steel tensile capacity.

#Note: Design Tensile Capacity ϕN_{ur} = minimum of ϕN_{uc} and ϕN_{us}

For Cracked Concrete performance, please use the simplified strength limit state design process to verify capacity.

Data is based on a Service temperature limit of -40°C to +40°C

All data relevant for Dry and Wet Holes. For Flooded Holes MULTIPLY ϕN_{uc} x 0.63

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	58	450	650	62.3
M12	10.4	84.3	640	800	10	84.3	450	650	109.2
M16	14.1	157	640	800	14	157	450	650	277.5
M20	17.7	245	640	800	17.2	245	450	650	540.9
M24	21.2	353	640	800	20.7	353	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.

ChemSet™ EPCON™ G5 Xtrem™

STRENGTH LIMIT STATE DESIGN

STEP 1 Select anchor to be evaluated

Table 1a Indicative combined loading – interaction diagram

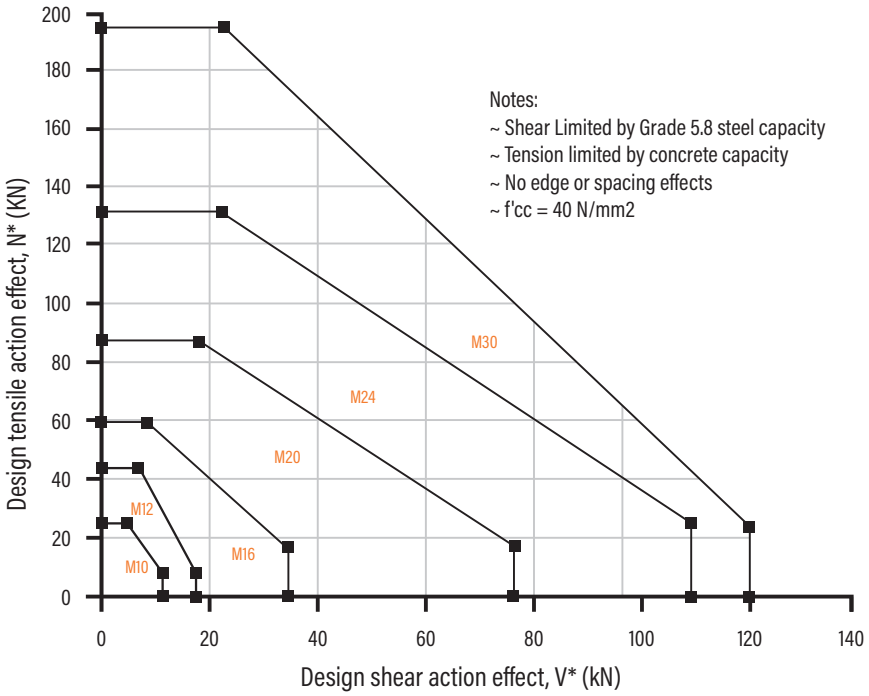


Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

Anchor size, d_b	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 on page 141.

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

STEP 2

Verify concrete tensile capacity - per anchor

Table 2a Reduced characteristic ultimate concrete tensile capacity, ϕN_{uc} (kN), ϕ_c= 1/1.5 = 0.67, f'_{cc}= 40 N/mm2

	Combined pull-out and concrete cone resistance - ϕN_{ucp}						Concrete Cone Resistance - ϕN_{ucc}
Anchor Size, d_b	M10	M12	M16	M20	M24	M30	
Drilled Hole Dia, d_h (mm)	12	14	18	25	28	35	
Effective Depth, h (mm)							
70	27.5						24.3
80	31.5						29.7
90	**35.5**	40.5					35.4
100	39.3	45.0					41.5
110	43.3	**49.5**	64.1				47.9
120	47.2	54.0	69.9				54.5
125	49.2	56.3	**72.8**				58.0
140	55.1	63.0	81.6				68.7
150	59.0	67.5	87.4	102.7			76.2
160	63.0	72.0	93.2	109.6	131.0		84.0
170	66.9	76.5	99.0	**116.4**	139.2		91.9
180	70.8	81.0	104.9	123.3	147.4		100.2
190	74.8	85.5	110.7	130.1	155.6		108.6
200	78.7	90.0	116.5	137.0	163.8		117.3
210		94.4	122.4	143.8	**172.0**	202.2	126.2
240		108.0	139.8	164.4	196.5	231.1	154.2
280			163.1	191.8	229.3	**269.6**	194.4
320			186.4	219.2	262.1	308.2	237.5
350				239.7	286.6	337.1	271.6
400				274.0	327.6	385.2	331.9
450					368.5	433.4	396.0
480					393.1	462.2	436.3
550						529.7	535.1
600						577.8	609.7

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

Table 2a-2 Cracked Concrete effect, tension, X_{ncr}

	Cracked Concrete Effect - X_{ncr} where $\phi N_{uc} = \phi N_{ucp}$ (from Table 2a)						X_{ncr} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
Anchor Size, d_b	M10	M12	M16	M20	M24	M30	
f'cc (N/mm2)							
25 to 60	0.36	0.53	0.57	0.65	0.63	0.68	0.70

Bold values are at Chemset Anchor Stud nominal Depths. For Sustained Loads MULTIPLY ϕN_{uc} x 0.72 (100 years). All data relevant for Dry and Wet Holes. For Flooded Holes MULTIPLY ϕN_{uc} x 0.63 For Non-cracked concrete X_{ncr} = 1.

Calculate ϕN_{urc} for both ϕN_{ucp} and ϕN_{ucc} then choose the minimum - Refer to Checkpoint 2

Table 2b-1 Concrete service temperature limits effect, tension, X_{ns}

	Service temperature limits effect, tension, X_{ns}						X_{ns} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
Anchor Size, d_b	M10	M12	M16	M20	M24	M30	
Service temperature (°C)							
T1: -40°C to +40°C	1.00						1.00
T2: -40°C to +60°C	0.84						
T3: -40°C to +75°C	0.26						

Table 2b-2 Concrete compressive strength effect, tension, X_{nc}

NON-CRACKED	Non-Cracked Concrete - X_{nc} where $\phi N_{uc} = \phi N_{ucp}$ (from Table 2a)						X_{nc} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
Anchor Size, d_b	M10	M12	M16	M20	M24	M30	
f'cc (N/mm2)							
25	0.91	0.91	0.87	0.87	0.83	0.83	0.79
30	0.95	0.95	0.93	0.93	0.91	0.91	0.88
40	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50	1.05	1.05	1.07	1.07	1.09	1.09	1.12
60	1.09	1.09	1.14	1.14	1.20	1.20	1.25

CRACKED	Cracked Concrete - X_{nc} where $\phi N_{uc} = \phi N_{ucp}$ (from Table 2a)						X_{nc} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
Anchor Size, d_b	M10	M12	M16	M20	M24	M30	
f'cc (N/mm2)							
25	0.95	0.95	0.95	0.91	0.91	0.87	0.79
30	0.98	0.98	0.98	0.95	0.95	0.93	0.88
40	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50	1.02	1.02	1.02	1.05	1.05	1.07	1.12
60	1.05	1.05	1.05	1.09	1.09	1.14	1.25

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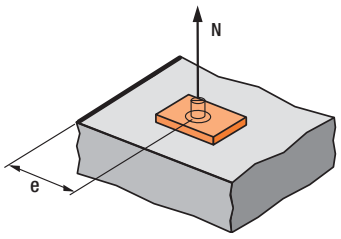
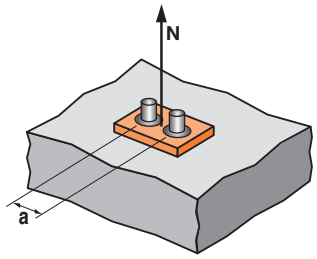


$X_{ne} = 0.25 + 0.5*(e/h)$
Where $e_m \le e \le e_c$
$e_c = 1.5*h$
Note: Tabled values are based on the nominal effective depth, h shown in the installation details. For other values of X_{ne}, please use equation shown above.

Table 2c - Concrete Edge distance effect, tension, X_{ne}

Anchor size, d_b	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	0.86	0.79	0.65	0.57	0.49
165		1	0.91	0.74	0.64	0.54
187			1	0.80	0.70	0.58
255				1	0.86	0.71
315					1	0.81
420						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 - 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			
85	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	0.91	0.86	0.76	0.71	0.66
330		1	0.94	0.82	0.76	0.70
375			1	0.87	0.80	0.72
510				1	0.90	0.80
630					1	0.88
840						1

Checkpoint 2

Design reduced ultimate concrete tensile capacity, ϕN_{urc}
ϕN_{urc} = minimum of $\phi N_{ucp} *X_{ncr} *X_{ns} *X_{nc} *X_{ne} *X_{na}$ and $\phi N_{ucc} *X_{ncr} *X_{ns} *X_{nc} *X_{ne} *X_{na}$

STEP 3

Verify anchor tensile capacity - per anchor

Table 3a Reduced characteristic ultimate steel tensile capacity, ϕN_{us} (kN) where ϕ_n = 0.67 for Gr 5.8 & Gr 8.8

Anchor size, d_b	M10	M12	M16	M20	M24	M30
ChemSet™ Anchor Stud Grade 5.8 Carbon Steel	19.3	28.1	52.3	81.7	117.7	187.0
ChemSet™ Anchor Stud A4/316 Stainless Steel	23.5	34.2	63.7	99.5	143.3	227.8
ChemSet™ Anchor Stud Grade 8.8 Carbon Steel	30.9	44.9	83.7	130.7	188.3	299.2

Note ϕ_n = 0.58 for ChemSet™ Anchor Stud A4/316 Stainless Steel

Checkpoint 3

Design reduced ultimate tensile capacity, ϕN_{ur}
ϕN_{ur} = minimum of ϕN_{urc}, ϕN_{us}
Check $N^*/\phi N_{ur} \le 1.0$,
if not satisfied return to step 1

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STRENGTH LIMIT STATE DESIGN

STEP 4

Step 4 - Verify concrete shear capacity - per anchor

Table 4a - 1 Reduced characteristic ultimate concrete edge shear capacity, ϕV_{uc} (kN), ϕ = 1/1.5 = 0.67, f'_{cc}= 40 N/mm2

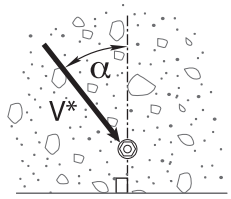
Anchor size, d_b	M10	M12	M16	M20	M24	M30
Effective depth, h (mm)	70 - 200	90 - 240	110 - 320	150 - 400	160 - 480	210 - 600
Edge distance, e_m						
40	4.3	4.7				
45			6.2			
55				9.1		
60					10.8	
90						20.0

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

Table 4a-2 Cracked Concrete effect, shear, X_{vcr}

Anchor size, d_b	M10	M12	M16	M20	M24	M30
X_{vcr}	0.70					

For Non-cracked concrete X_{vcr} = 1.0



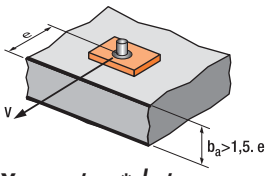
Load direction effect, conc. edge shear, X_{vd}

Table 4b - Concrete compressive strength effect, shear, X_{vc}

f'_{cc}(N/mm2)	25	30	40	50	60
X_{vc}	0.79	0.86	1	1.11	1.22

Table 4c - 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

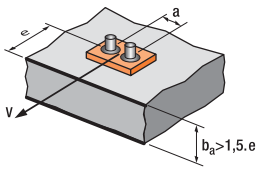


$$X_{ve} = e/e_m * \sqrt{e/e_m}$$

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

For single anchor fastening X_{ve}

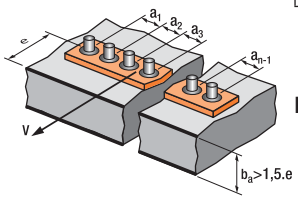
e/e_m	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
X_{ve}	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72



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

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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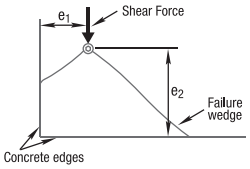
STRENGTH LIMIT STATE DESIGN

Table 4e Reduced characteristic ultimate concrete pryout capacity, ϕV_{ucp} (kN), ϕ = 1/1.5 = 0.67, f'_{cc}= 40 N/mm2

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	70.8	95.7	116.0	183.9	252.5	388.7
-40°C to +60°C	59.5	83.2	116.0	183.9	252.5	388.7
-40°C to +75°C	18.4	25.7	37.9	60.5	89.4	140.2



ANCHOR AT A CORNER

Table 4f Anchor at a corner effect, 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 reduced ultimate concrete edge shear capacity, ϕV_{urc}

$\phi V_{urc} = \phi V_{uc} * X_{vcr} * X_{vc} * X_{vd} * X_{ve} * X_{vs}$

Checkpoint 4b

Design reduced ultimate concrete pryout capacity, ϕV_{urcp}

$\phi V_{urcp} = \phi V_{ucp} * X_{ncr} * X_{nc} * X_{ne} * X_{na}$

STEP 5

Verify anchor shear capacity - per anchor

Table 5a Reduced characteristic ultimate steel shear capacity, ϕV_{us} (kN) where ϕ_v = 0.67 for Gr 5.8 and Gr 8.8, = 0.64 for A4/316

Anchor size, d_b	M10	M12	M16	M20	M24	M30
ChemSet™ Anchor Stud Grade 5.8 Carbon Steel	9.7	14.1	26.2	40.8	58.8	93.5
ChemSet™ Anchor Stud A4/316 Stainless Steel	13.0	18.9	35.2	55.0	79.2	125.9
ChemSet™ Anchor Stud Grade 8.8 Carbon Steel	15.5	22.5	41.9	65.3	94.1	149.6

Checkpoint 5

Design reduced ultimate shear capacity, ϕV_{ur}

ϕV_{ur} = minimum of ϕV_{urc}, ϕV_{urcp}, ϕV_{us}

Check $V^*/\phi V_{ur} \leq 1.0$,

if not satisfied return to step 1

ChemSet™ EPCON™ G5 Xtrem™

STRENGTH LIMIT STATE DESIGN

STEP 6

Combined Loading

Checkpoint 6

Check
$N^*/\phi N_{ur} + V^*/\phi V_{ur} \leq 1.2$,
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.

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

ChemSet™ EPCON™ G5 Xtrem™

CHEMICAL INJECTION - NON-CRACKED & CRACKED CONCRETE

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

GENERAL INFORMATION

Performance Related	Installation Related

Product

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

Principal Applications

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

Compliance

European Technical Assessment - ETA-25/0648
Design according to:

- AS 5216 (formerly TS101)
- EN 1992-4 (formerly ETAG001 Annex C, E & TR045)
- 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

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

Installation and Substrate Temperatures Range

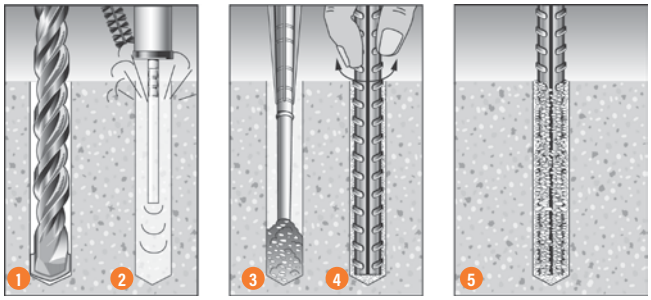
Minimum	Maximum
5°C	40°C

For correct installation, make sure to use only genuine Ramset tools

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.

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

ChemSet™ EPCON™ G5 Xtrem™

CHEMICAL INJECTION - NON-CRACKED & CRACKED CONCRETE

Installation and performance details: ChemSet™ EPCON™ G5 Xtrem™ and Reinforcing Bar

Anchor Size, d_b (mm)	Drilled Hole diam., d_h (mm)	Anchor Effective Depth, h (mm)	Optimum dimensions*			Recommended Load # (FOS = 3)				
			Edge* distance, e_c (mm)	Anchor spacing, a_c (mm)	Concrete substrate thickness, b_m (mm)	Gr 500 Rebar - Steel		Non-Cracked Concrete		
						Tension, ϕN_{us} (kN)***	Shear, ϕV_{us} (kN)	Tension, ϕN_{uc} (kN)**		
								Concrete compressive strength, f'_{cc}		
								25 N/mm2	40 N/mm2	50 N/mm2
10	12	90	135	270	115	14.1	7.1	13.7	13.7	13.7
12	15	110	165	330	140	20.4	10.2	18.9	20.5	20.8
16	20	125	187	375	160	36.2	18.1	22.9	29.0	31.2
20	25	150	225	450	190	56.5	28.3	30.1	38.1	42.6
		170	255	510	215			36.3	46.0	51.4
25	30	180	270	540	215	88.4	44.2	39.6	50.1	56.0
		210	315	630	275			49.9	63.1	70.6
32	40	240	360	720	320	144.8	72.4	61.0	77.1	86.2
		300	450	900	380			85.2	107.8	120.5

* Note: For shear loads acting towards an edge or where these optimum dimensions are not achievable, please use the simplified strength limit state design process to verify capacity.
Note: Recommended concrete tensile capacity = ϕN_{uc} and N_{uc} = Characteristic ultimate concrete tensile capacity. ϕ **= 3 on the above table
***Note: Recommended steel tensile capacity = ϕN_{us} where ϕ = 3 on the above table and N_{us} = Characteristic ultimate steel tensile capacity.
#Note: Recommended Tensile Capacity ϕN_{ur} = minimum of ϕN_{uc} and ϕN_{us}
For Cracked Concrete performance, please use the simplified strength limit state design process to verify capacity.
Data is based on a **Service temperature limit of -40°C to +40°C**
All data relevant for Dry and Wet Holes. For Flooded Holes MULTIPLY ϕN_{uc} x 0.65
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

Typical Engineering Properties of Grade 500 Reinforcing Bar

Rebar Size	10	12	16	20	25	32
Drilled Hole Dia, d_h (mm)	12	15	20	25	30	40
Stress Area, A_s (mm^2)	78.5	113	201	314	491	804
Yield Stress, f_{sy} (MPa)	500	500	500	500	500	500
Tensile Steel Yield Capacity, N_{sy} (kN)	39.3	56.5	100.5	157.0	245.5	402.0

For further information refer to reinforcing bar manufacturer's published information and current revision of **AS/NZS 4671**

ChemSet™ EPCON™ G5 Xtrem™

STRENGTH LIMIT STATE DESIGN

STEP 1 Select anchor to be evaluated

Table 1a Indicative combined loading – interaction diagram

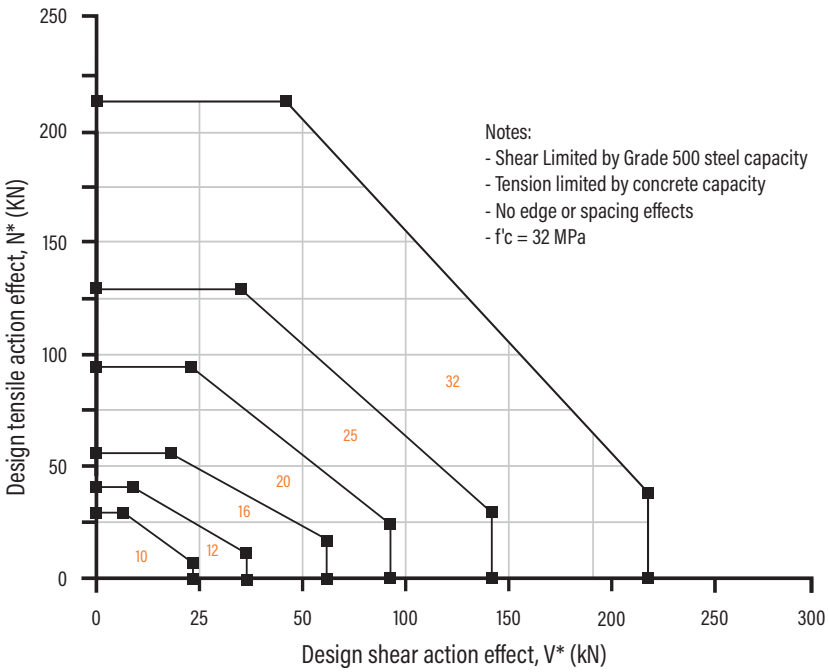


Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

Anchor size, d_b	10	12	16	20	25	32
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 nominal recommended effective depths, h, listed in installation and performance details table on previous page.

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)		
10	12	16 to 32
h + 30mm ≥ 100mm		h + (2 x d_h)

Checkpoint 1 **Anchor size determined, absolute minima compliance achieved, effective depth (h) calculated.**

ChemSet™ EPCON™ G5 Xtrem™

STRENGTH LIMIT STATE DESIGN

STEP 2 Verify concrete tensile capacity - per anchor

Table 2a Reduced characteristic ultimate concrete tensile capacity, ϕN_{uc} (kN), ϕ_c = 1/1.5 = 0.67, f'$_{cc}$= 40N/mm2

	Combined pull-out and concrete cone resistance - ϕN_{ucp}						Concrete Cone Resistance - ϕN_{ucc}
Rebar Size, d_b	10	12	16	20	25	32	
Drilled Hole Dia, d_h (mm)	12	15	20	25	30	40	
Effective Depth, h (mm)							
70	21.3						24.3
80	24.3						29.7
90	**27.3**	33.6					35.4
100	30.4	37.3					41.5
110	33.4	**41.0**					47.9
120	36.4	44.8	59.3				54.5
125	38.0	46.6	**61.8**				58.0
140	42.5	52.2	69.2				68.7
150	45.6	56.0	74.1	92.6			76.2
160	48.6	59.7	79.0	98.8			84.0
170	51.6	63.4	84.0	**105.0**			91.9
180	54.7	67.2	88.9	111.2	141.3		100.2
190	57.7	70.9	93.9	117.3	149.1		108.6
200	60.7	74.6	98.8	123.5	157.0		117.3
210		78.3	103.7	129.7	**164.8**		126.2
240		89.5	118.6	148.2	188.3	241.1	154.2
270			133.4	166.7	211.9	271.2	184.0
280			138.3	172.9	219.7	281.3	194.4
300			148.2	185.3	235.4	**301.4**	215.6
320			158.1	197.6	251.1	321.4	237.5
350				216.1	274.7	351.6	271.6
400				247.0	313.9	401.8	331.9
450					353.1	452.0	396.0
500					392.4	502.3	463.8
560						562.5	549.7
640						642.9	671.7

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

Table 2a-2 Cracked Concrete effect, tension, X_{ncr}

	Cracked Concrete Effect - X_{ncr} where $\phi N_{uc} = \phi N_{ucp}$ (from Table 2a)						X_{ncr} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
Rebar Size, d_b	10	12	16	20	25	32	
f'cc (N/mm2)							
25 to 60	0.74	0.73	0.71	0.70	0.70	0.67	0.70

Bold values are at Chemset Anchor Stud nominal Depths. For Sustained Loads MULTIPLY ϕN_{uc} x 0.72 (100 years) All data relevant for Dry and Wet Holes.
For Flooded Holes MULTIPLY ϕN_{uc} x 0.65. For Non-cracked concrete X_{ncr} = 1.0.

Calculate ϕN_{urc} for both ϕN_{ucp} and ϕN_{ucc} then choose the minimum - Refer to Checkpoint 2

Table 2b-1 Concrete service temperature limits effect, tension, X_{ns}

	Service temperature limits effect, tension, X_{ns} where $\phi N_{uc} = \phi N_{ucp}$ (from Table 2a)						X_{ns} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
Rebar Size, d_b	10	12	16	20	25	32	
Service temperature (°C)							
T1: -40°C to +40°C	1.00						1.00
T2: -40°C to +60°C	0.84						
T3: -40°C to +75°C	0.25						

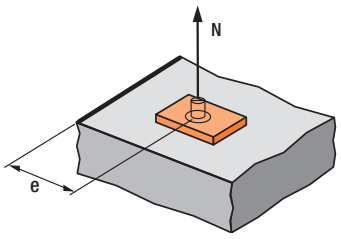
Table 2b-2 Concrete compressive strength effect, tension, X_{nc}

NON-CRACKED	Non-Cracked Concrete - X_{nc} where $\phi N_{uc} = \phi N_{ucp}$ (from Table 2a)						X_{nc} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
Anchor Size, d_b	10	12	16	20	25	32	
f'cc (N/mm2)							
25	1.00	0.98	0.98	0.98	0.95	0.95	0.79
30	1.00	0.99	0.99	0.99	0.97	0.97	0.88
40	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50	1.00	1.01	1.01	1.01	1.02	1.02	1.12
60	1.00	1.02	1.02	1.02	1.04	1.04	1.25

CRACKED	Cracked Concrete - X_{nc} where $\phi N_{uc} = \phi N_{ucp}$ (from Table 2a)						X_{nc} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
Anchor Size, d_b	10	12	16	20	25	32	
f'cc (N/mm2)							
25	0.95	0.95	0.95	0.91	0.88	0.87	0.79
30	0.97	0.97	0.97	0.95	0.94	0.93	0.88
40	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50	1.02	1.02	1.02	1.04	1.04	1.07	1.12
60	1.04	1.04	1.04	1.09	1.09	1.14	1.25

ChemSet™ EPCON™ G5 Xtrem™

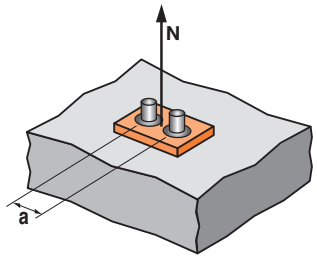
STRENGTH LIMIT STATE DESIGN



$X_{ne} = 0.25 + 0.5*(e/h)$
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 - Concrete Edge distance effect, tension, X_{ne}

Anchor size, d_b	10	12	16	20	25	32
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	0.40
100	0.81	0.70	0.65	0.54	0.49	0.42
115	0.89	0.77	0.71	0.59	0.52	0.44
135	1	0.86	0.79	0.65	0.57	0.48
165		1	0.91	0.74	0.64	0.53
187			1	0.80	0.70	0.56
255				1	0.86	0.68
315					1	0.78
450						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 - Concrete anchor spacing effect, tension, X_{na}

Anchor size, d_b	10	12	16	20	25	32
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			
85	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	0.59
200	0.87	0.80	0.77	0.70	0.66	0.61
270	1	0.91	0.86	0.76	0.71	0.65
330		1	0.94	0.82	0.76	0.68
375			1	0.87	0.80	0.71
510				1	0.90	0.78
630					1	0.85
900						1

Checkpoint 2

Design reduced ultimate concrete tensile capacity, ϕN_{urc}
ϕN_{urc} = minimum of $\phi N_{ucp} *X_{ncr} *X_{ns} *X_{nc} *X_{ne} *X_{na}$ and $\phi N_{ucc} *X_{ncr} *X_{ns} *X_{nc} *X_{ne} *X_{na}$

STEP 3

Verify anchor tensile capacity - per anchor

Table 3a Reduced characteristic ultimate steel tensile capacity. ϕN_{us} (kN), where ϕ = 0.8

Anchor size, d_b	10	12	16	20	24	32
Gr 500 Rebar	31.4	45.2	80.4	125.6	196.4	321.6

Checkpoint 3

Design reduced ultimate tensile capacity, ϕN_{ur}
ϕN_{ur} = minimum of ϕN_{urc}, ϕN_{us}
Check $N^*/\phi N_{ur} \le 1.0$,
if not satisfied return to step 1

ChemSet™ EPCON™ G5 Xtrem™

STRENGTH LIMIT STATE DESIGN

STEP 4

Step 4 - Verify Concrete Edge Shear Resistance - per anchor

Table 4a-1 Reduced characteristic ultimate concrete edge shear capacity, ϕV_{uc} (kN), ϕ = 1/1.5 = 0.67, f'_{cc}= 40 N/mm2

Rebar size, d_b	10	12	16	20	25	32
Effective depth, h (mm)	70 - 200	90 - 240	120 - 320	150 - 400	180 - 500	240 - 640
Edge distance, e_m						
40	4.3	4.7				
45			6.3			
55				9.1		
60					11.2	
90						21.3

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

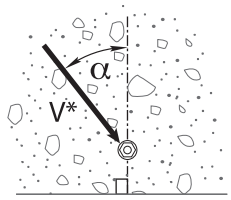
Table 4a-2 Cracked Concrete effect, shear, X_{vcr}

Anchor size, d_b	10	12	16	20	25	32
X_{vcr}	0.70					

For Non-cracked concrete X_{vcr} = 1.0

Table 4b - Concrete compressive strength effect, shear, X_{vc}

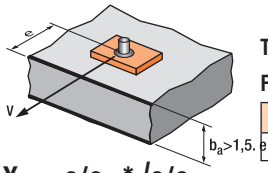
f'c (MPa)	20	25	32	40	50
X_{vc}	0.79	0.86	1	1.11	1.22



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

Table 4c - 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

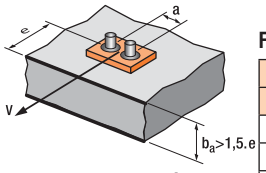


$$X_{ve} = e/e_m * \sqrt{e/e_m}$$

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

For single anchor fastening X_{ve}

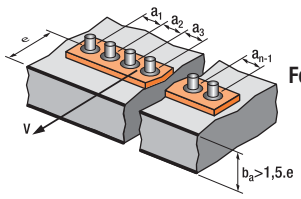
e/e_m	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
X_{ve}	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72



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

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

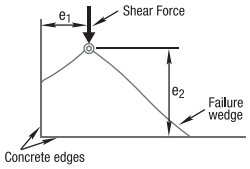


For 3 anchors fastening and more

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

ChemSet™ EPCON™ G5 Xtrem™

STRENGTH LIMIT STATE DESIGN



ANCHOR AT A CORNER

Table 4e Reduced characteristic ultimate concrete pryout capacity, ϕV_{ucp} (kN), ϕ = 1/1.5 = 0.67, f'_c = 40 N/mm2

Rebar size, d_b	10	12	16	20	25	32
Effective depth, h (mm)	90	110	125	170	210	300
T1: -40°C to +40°C	54.7	82.1	116.0	183.9	252.5	431.1
T2: -40°C to +60°C	45.9	68.9	103.7	176.4	252.5	431.1
T3: -40°C to +75°C	13.7	20.5	30.9	52.5	82.4	150.7

Table 4f Anchor at a corner effect, 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 reduced ultimate concrete edge shear capacity, ϕV_{urc}

$\phi V_{urc} = \phi V_{uc} * X_{vcr} * X_{vc} * X_{vd} * X_{ve} * X_{vs}$

Checkpoint 4b

Design reduced ultimate concrete pryout capacity, ϕV_{urcp}

$\phi V_{urcp} = \phi V_{ucp} * X_{ncr} * X_{nc} * X_{ne} * X_{na}$

STEP 5

Verify anchor shear capacity - per anchor

Table 5a Reduced characteristic ultimate steel shear capacity, ϕV_{us}, (kN) where ϕ_v = 0.67

Anchor size, d_b	10	12	16	20	25	32
Gr 500 Rebar	21.4	30.8	54.8	85.7	133.9	219.3

Checkpoint 5

Design reduced ultimate shear capacity, ϕV_{ur}

ϕV_{ur} = minimum of ϕV_{urc}, ϕV_{urcp}, ϕV_{us}

Check $V^*/\phi V_{ur} \leq 1.0$,

if not satisfied return to step 1

ChemSet™ EPCON™ G5 Xtrem™

STRENGTH LIMIT STATE DESIGN

STEP 6 Combined loading and specification

Checkpoint 6

Check
$N^*/\phi N_{ur} + V^*/\phi V_{ur} \leq 1.2$,
if not satisfied return to step 1

Specify – Reinforcing Bar Anchorage

Ramset™ EPCON™ G5 Xtrem™ Injection (Anchor Size) grade 500 Rebar.
Drilled hole depth to be (h) mm.

Example

Ramset™ EPCON™ G5 Xtrem™ Injection with 16mm grade 500 Rebar
Drilled hole depth to be 125 mm.
To be installed in accordance with Ramset™ Installation Instructions.

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

Chemset™ EPCON™ G5 Xtrem™

FIRE RATED CHEMICAL ANCHOR

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

GENERAL INFORMATION

Performance Related	Installation Related

Product

ChemSet™ 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 - ETA-25/0647 and ETA-25/1142

Design according to:

- AS 5216 (formerly TS101)
- EN 1992-4 (formerly ETAG001 Annex C, E & TR045)
- Fire Design according to EN 1992-1-1 and EN 1992-1-2.
- 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

Principal Applications

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

Benefits, Advantages and Features

- 120 year working Life
- Fire tested to European Assessment Document

Greater productivity:

- Anchors in dry, damp, wet or flooded holes

Greater security:

- Strong bond
- Rated for sustained loading

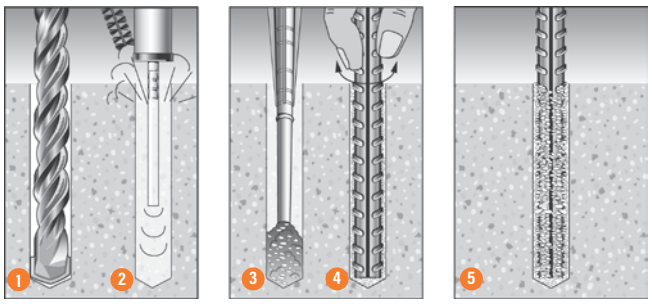
Versatile:

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

Greater safety:

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

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.
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.

Installation and Substrate Temperatures Range

Minimum	Maximum
5°C	40°C

For correct installation, make sure to use only genuine Ramset tools

Service Temperature Limits

-40°C to +75°C

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

Chemset™ EPCON™ G5 Xtrem™

FIRE RATED CHEMICAL ANCHOR

Installation Details

ChemSet™ EPCON™ G5 Xtrem™ with Reinforcing Bar

Anchor size, d_b (mm)	Drilled hole diameter, d_h (mm)
10	12
12	15
16	20
20	25
24	30
25	30
28	35
32	40
36	45
40	50

DESCRIPTION AND PART NUMBERS

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

ENGINEERING PROPERTIES

Typical Engineering Properties of Grade 500 Reinforcing Bar

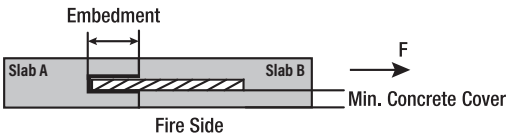
Rebar size	10	12	16	20	24	25	28	32	36	40
Drilled hole dia, d_h (mm)	12	15	20	25	30	30	35	40	45	50
Stress area, A_s (mm^2)	78.5	113	201	314	452	491	616	804	1020	1260
Yield stress, f_{sy} (MPa)	500	500	500	500	500	500	500	500	500	500
Tensile steel yield capacity, $N_{us} = N_{sy}$, (kN)	39.3	56.5	100.5	157.0	226.0	245.5	308.0	402.0	509.0	628.0
Design tensile steel resistance ϕN_{us} (kN)	34.2	49.2	87.5	136.7	196.8	213.5	267.9	349.9	442.8	546.6

For further information refer to reinforcing bar manufacturer's published information and current revision of **AS/NZS 4671**

Chemset™ EPCON™ G5 Xtrem™

FIRE RATED CHEMICAL ANCHOR

Reinforcing Bar Anchored with ChemSet™ EPCON™ G5 Xtrem™



Design Case 1

Fire resistance duration = 30 minutes

For Reinforcing Bar Steel Grade - 500 MPa and Concrete cube compressive strength f'_{cc} = 25 N/mm²

Rebar Size	Hole Diameter (mm)	*Min. Concrete Cover(mm)	**Design reistance in accordance with Eurocode 2 for fire duration 30 minutes - $R_{d,fi}$ (kN)													
10	12	50	3.32	4.98	6.64	8.30	9.96	11.62	13.28	14.94	16.59	18.25	19.91	23.23	26.55	29.87
		70	7.63	11.45	15.26	19.08	22.89	26.71	30.52	**34.16**	**34.16**	**34.16**	**34.16**	**34.16**	**34.16**	**34.16**
12	15	50	3.98	5.97	7.97	9.96	11.95	13.94	15.93	17.92	19.91	21.91	23.90	27.88	31.86	35.84
		70	9.16	13.73	18.31	22.89	27.47	32.05	36.63	41.20	45.78	**49.20**	**49.20**	**49.20**	**49.20**	**49.20**
16	20	50		7.97	10.62	13.28	15.93	18.59	21.24	23.90	26.55	29.21	31.86	37.17	42.48	47.79
		70		18.31	24.42	30.52	36.63	42.73	48.83	54.94	61.04	67.15	73.25	85.46	**87.46**	**87.46**
20	25	50			13.28	16.59	19.91	23.23	26.55	29.87	33.19	36.51	39.83	46.47	53.10	59.74
		70			30.52	38.15	45.78	53.41	61.04	68.67	76.30	83.93	91.56	106.83	122.09	**136.66**
24	30	50				19.91	23.90	27.88	31.86	35.84	39.83	43.81	47.79	55.76	63.72	71.69
		70				45.78	54.94	64.10	73.25	82.41	91.56	100.72	109.88	128.19	146.50	164.82
25	30	50				20.74	24.89	29.04	33.19	37.34	41.49	45.64	49.78	58.08	66.38	74.68
		70				47.69	57.23	66.77	76.30	85.84	95.38	104.92	114.46	133.53	152.61	171.68
28	35	50					27.88	32.53	37.17	41.82	46.47	51.11	55.76	65.05	74.34	83.64
		70					64.10	74.78	85.46	96.14	106.83	117.51	128.19	149.56	170.92	192.29
32	40	50						37.17	42.48	47.79	53.10	58.41	63.72	74.34	84.97	95.59
		70						85.46	97.67	109.88	122.09	134.30	146.50	170.92	195.34	219.76
36	45	50						41.82	47.79	53.77	59.74	65.72	71.69	83.64	95.59	107.53
		70						96.14	109.88	123.61	137.35	151.08	164.82	192.29	219.76	247.23
40	50	50						46.47	53.10	59.74	66.38	73.02	79.66	92.93	106.21	119.48
		70						106.83	122.09	137.35	152.61	167.87	183.13	213.65	244.17	274.69
Embedment (mm)			100	150	200	250	300	350	400	450	500	550	600	700	800	900

*Note: Minimum concrete cover based on minimum slab thickness of 200mm according to Eurocode 2 Part 1.2 (EN 1992-1-2)

**Note: Performance data based on hammer drilling technique. For data using core drilling technique, please refer to Ramset Engineer.

Bold values depicts design tensile steel resistance governs.

Design Case 2

Fire resistance duration = 60 minutes

For Reinforcing Bar Steel Grade - 500 MPa and Concrete cube compressive strength f'_{cc} = 25 N/mm²

Rebar Size	Hole Diameter (mm)	*Min. Concrete Cover(mm)	**Design reistance in accordance with Eurocode 2 for fire duration 60 minutes - $R_{d,fi}$ (kN)													
10	12	80	3.64	5.47	7.29	9.11	10.93	12.76	14.58	16.40	18.22	20.04	21.87	25.51	29.15	32.80
		100	6.60	9.91	13.21	16.51	19.81	23.12	26.42	29.72	33.02	**34.16**	**34.16**	**34.16**	**34.16**	**34.16**
12	15	80	4.37	6.56	8.75	10.93	13.12	15.31	17.49	19.68	21.87	24.05	26.24	30.61	34.99	39.36
		100	7.93	11.89	15.85	19.81	23.78	27.74	31.70	35.67	39.63	43.59	47.55	**49.20**	**49.20**	**49.20**
16	20	80		8.75	11.66	14.58	17.49	20.41	23.32	26.24	29.15	32.07	34.99	40.82	46.65	52.48
		100		15.85	21.13	26.42	31.70	36.99	42.27	47.55	52.84	58.12	63.40	73.97	84.54	**87.46**
20	25	80			14.58	18.22	21.87	25.51	29.15	32.80	36.44	40.09	43.73	51.02	58.31	65.60
		100			26.42	33.02	39.63	46.23	52.84	59.44	66.05	72.65	79.26	92.46	105.67	118.88
24	30	80				21.87	26.24	30.61	34.99	39.36	43.73	48.10	52.48	61.22	69.97	78.72
		100				39.63	47.55	55.48	63.40	71.33	79.26	87.18	95.11	110.96	126.81	142.66
25	30	80				22.78	27.33	31.89	36.44	41.00	45.55	50.11	54.66	63.78	72.89	82.00
		100				41.28	49.53	57.79	66.05	74.30	82.56	90.81	99.07	115.58	132.09	148.60
28	35	80					30.61	35.71	40.82	45.92	51.02	56.12	61.22	71.43	81.63	91.84
		100					55.48	64.73	73.97	83.22	92.46	101.71	110.96	129.45	147.94	166.44
32	40	80						40.82	46.65	52.48	58.31	64.14	69.97	81.63	93.29	104.96
		100						73.97	84.54	95.11	105.67	116.24	126.81	147.94	169.08	190.21
36	45	80						45.92	52.48	59.04	65.60	72.16	78.72	91.84	104.96	118.08
		100						83.22	95.11	107.00	118.88	130.77	142.66	166.44	190.21	213.99
40	50	80						51.02	58.31	65.60	72.89	80.17	87.46	102.04	116.62	131.19
		100						92.46	105.67	118.88	132.09	145.30	158.51	184.93	211.35	237.77
Embedment (mm)			100	150	200	250	300	350	400	450	500	550	600	700	800	900

*Note: Minimum concrete cover based on minimum slab thickness of 200mm according to Eurocode 2 Part 1.2 (EN 1992-1-2)

**Note: Performance data based on hammer drilling technique. For data using core drilling technique, please refer to Ramset Engineer.

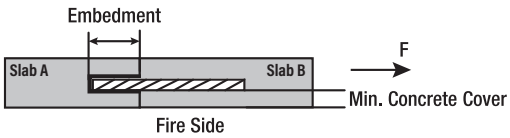
Bold values depicts design tensile steel resistance governs.

Note: Design resistance is based on 25 N/mm2 concrete strength. For values in higher concrete strengths, and design optimisation, please refer to Ramset iExpert Anchor Software.

Chemset™ EPCON™ G5 Xtrem™

FIRE RATED CHEMICAL ANCHOR

Reinforcing Bar Anchored with ChemSet™ EPCON™ G5 Xtrem™



Design Case 3

Fire resistance duration = 90 minutes

For Reinforcing Bar Steel Grade - 500 MPa and Concrete cube compressive strength f'_{cc} = 25 N/mm²

Rebar Size	Hole Diameter (mm)	*Min. Concrete Cover(mm)	**Design reistance in accordance with Eurocode 2 for fire duration 90 minutes - $R_{d,fi}$ (kN)													
10	12	90	4.05	5.39	6.74	8.09	9.44	10.79	12.14	13.49	14.84	16.18	18.88	21.58	24.28	26.97
		100	5.28	7.03	8.79	10.55	12.31	14.07	15.83	17.59	19.34	21.10	24.62	28.14	31.65	**34.16**
12	15	90	4.86	6.47	8.09	9.71	11.33	12.95	14.57	16.18	17.80	19.42	22.66	25.90	29.13	32.37
		100	6.33	8.44	10.55	12.66	14.77	16.88	18.99	21.10	23.21	25.32	29.54	33.76	37.98	42.20
16	20	90		8.63	10.79	12.95	15.11	17.26	19.42	21.58	23.74	25.90	30.21	34.53	38.84	43.16
		100		11.25	14.07	16.88	19.70	22.51	25.32	28.14	30.95	33.76	39.39	45.02	50.65	56.27
20	25	90			13.49	16.18	18.88	21.58	24.28	26.97	29.67	32.37	37.76	43.16	48.55	53.95
		100			17.59	21.10	24.62	28.14	31.65	35.17	38.69	42.20	49.24	56.27	63.31	70.34
24	30	90				19.42	22.66	25.90	29.13	32.37	35.61	38.84	45.32	51.79	58.27	64.74
		100				25.32	29.54	33.76	37.98	42.20	46.42	50.65	59.09	67.53	75.97	84.41
25	30	90				20.23	23.60	26.97	30.35	33.72	37.09	40.46	47.21	53.95	60.69	67.44
		100				26.38	30.77	35.17	39.57	43.96	48.36	52.76	61.55	70.34	79.13	87.93
28	35	90					26.44	30.21	33.99	37.76	41.54	45.32	52.87	60.42	67.98	75.53
		100					34.47	39.39	44.31	49.24	54.16	59.09	68.93	78.78	88.63	98.48
32	40	90						34.53	38.84	43.16	47.48	51.79	60.42	69.05	77.69	86.32
		100						45.02	50.65	56.27	61.90	67.53	78.78	90.04	101.29	112.55
36	45	90						38.84	43.70	48.55	53.41	58.27	67.98	77.69	87.40	97.11
		100						50.65	56.98	63.31	69.64	75.97	88.63	101.29	113.95	126.61
40	50	90						43.16	48.55	53.95	59.34	64.74	75.53	86.32	97.11	107.90
		100						56.27	63.31	70.34	77.37	84.41	98.48	112.55	126.61	140.68
Embedment (mm)			150	200	250	300	350	400	450	500	550	600	700	800	900	1000

*Note: Minimum concrete cover based on minimum slab thickness of 200mm according to Eurocode 2 Part 1.2 (EN 1992-1-2)

**Note: Performance data based on hammer drilling technique. For data using core drilling technique, please refer to Ramset Engineer.

Bold values depicts design tensile steel resistance governs

Design Case 4

Fire resistance duration = 120 minutes

For Reinforcing Bar Steel Grade - 500 MPa and Concrete cube compressive strength f'_{cc} = 25 N/mm²

Rebar Size	Hole Diameter (mm)	*Min. Concrete Cover(mm)	**Design reistance in accordance with Eurocode 2 for fire duration 120 minutes - $R_{d,fi}$ (kN)													
10	12	90	3.64	4.55	5.47	6.38	7.29	8.20	9.11	10.02	10.93	12.75	14.57	16.40	18.22	20.04
		100	4.64	5.80	6.96	8.12	9.28	10.44	11.60	12.76	13.92	16.24	18.56	20.88	23.20	25.52
12	15	90	4.37	5.47	6.56	7.65	8.74	9.84	10.93	12.02	13.12	15.30	17.49	19.67	21.86	24.05
		100	5.57	6.96	8.35	9.74	11.13	12.53	13.92	15.31	16.70	19.48	22.27	25.05	27.84	30.62
16	20	90		7.29	8.74	10.20	11.66	13.12	14.57	16.03	17.49	20.40	23.32	26.23	29.15	32.06
		100		9.28	11.13	12.99	14.85	16.70	18.56	20.41	22.27	25.98	29.69	33.40	37.11	40.83
20	25	90			10.93	12.75	14.57	16.40	18.22	20.04	21.86	25.50	29.15	32.79	36.43	40.08
		100			13.92	16.24	18.56	20.88	23.20	25.52	27.84	32.47	37.11	41.75	46.39	51.03
24	30	90				15.30	17.49	19.67	21.86	24.05	26.23	30.60	34.98	39.35	43.72	48.09
		100				19.48	22.27	25.05	27.84	30.62	33.40	38.97	44.54	50.10	55.67	61.24
25	30	90				15.94	18.22	20.49	22.77	25.05	27.33	31.88	36.43	40.99	45.54	50.10
		100				20.30	23.20	26.10	29.00	31.89	34.79	40.59	46.39	52.19	57.99	63.79
28	35	90					20.40	22.95	25.50	28.05	30.60	35.71	40.81	45.91	51.01	56.11
		100					25.98	29.23	32.47	35.72	38.97	45.46	51.96	58.45	64.95	71.44
32	40	90						26.23	29.15	32.06	34.98	40.81	46.64	52.47	58.29	64.12
		100						33.40	37.11	40.83	44.54	51.96	59.38	66.80	74.23	81.65
36	45	90						29.51	32.79	36.07	39.35	45.91	52.47	59.02	65.58	72.14
		100						37.58	41.75	45.93	50.10	58.45	66.80	75.16	83.51	91.86
40	50	90						32.79	36.43	40.08	43.72	51.01	58.29	65.58	72.87	80.16
		100						41.75	46.39	51.03	55.67	64.95	74.23	83.51	92.78	102.06
Embedment (mm)			200	250	300	350	400	450	500	550	600	700	800	900	1000	1100

*Note: Minimum concrete cover based on minimum slab thickness of 200mm according to Eurocode 2 Part 1.2 (EN 1992-1-2)

**Note: Performance data based on hammer drilling technique. For data using core drilling technique, please refer to Ramset Engineer.

Note: Design resistance is based on 25N/mm2 concrete strength. For values in higher concrete strengths, and design optimisation, please refer to Ramset iExpert Anchor Software.