

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
- Easy dispensing even in cold weather

Greater security:

- Strong bond
- Rated for sustained loading

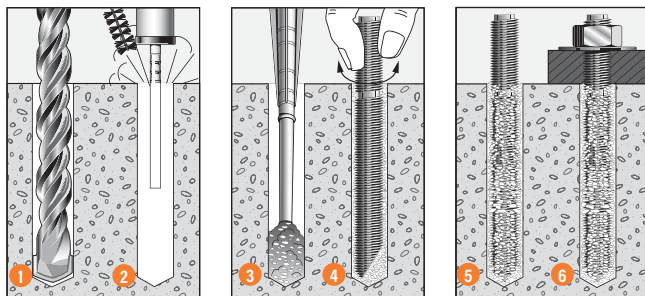
Versatile:

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

Greater safety:

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

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.



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

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)	Installation Details				Optimum dimensions*		
	Drilled hole diameter, d _h (mm)	Fixture hole diameter, d _f (mm)	Anchor effective depth, h (mm)	Tightening torque, T _t (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		
	Shear, φV _{us} (kN)	Tension, φN _{us} (kN)***	Shear, φV _{us} (kN)	Tension, φN _{us} (kN)***	Shear, φV _{us} (kN)	Tension, φN _{us} (kN)***	Tension, φN _{uc} (kN)**		
							Concrete Compressive Strength, f' _{cc}		
						25 N/mm ²	40 N/mm ²	50 N/mm ²	
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.

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STRENGTH LIMIT STATE DESIGN

STEP 1 Select anchor to be evaluated

Table 1a Indicative combined loading - interaction diagram

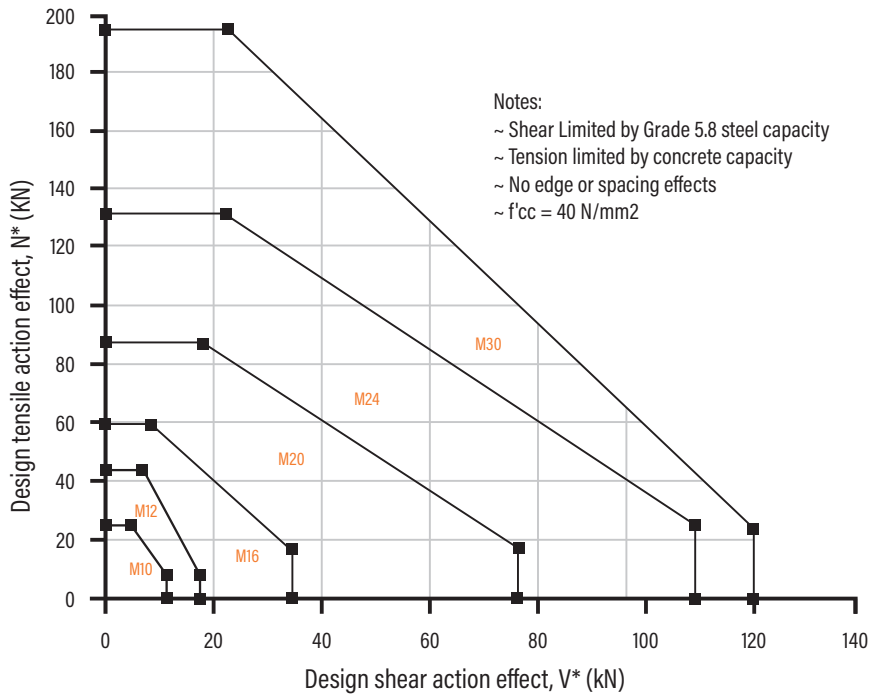


Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

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
	$h + 30\text{mm} \geq 100\text{mm}$		$h + (2 \times d_b)$

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), $\phi_c = 1/1.5 = 0.67$, $f'_{cc} = 40$ N/mm²

Anchor Size, d_b	Combined pull-out and concrete cone resistance - ϕN_{ucp}						Concrete Cone Resistance - ϕN_{ucc}
	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}

Anchor Size, d_b	Cracked Concrete Effect - X_{ncr}						X_{ncr} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
	where $\phi N_{uc} = \phi N_{ucp}$ (from Table 2a)						
f'_{cc} (N/mm ²)							
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_{uc} 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}

Anchor Size, d_b	Service temperature limits effect, tension, X_{ns}						X_{ns} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
	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			

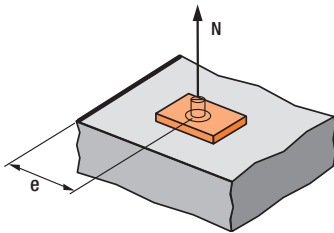
Table 2b-2 Concrete compressive strength effect, tension, X_{nc}

NON-CRACKED	Non-Cracked Concrete - X_{nc}						X_{nc} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
	where $\phi N_{uc} = \phi N_{ucp}$ (from Table 2a)						
Anchor Size, d_b							
f'_{cc} (N/mm ²)							
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}						X_{nc} where $\phi N_{uc} = \phi N_{ucc}$ (from Table 2a)
	where $\phi N_{uc} = \phi N_{ucp}$ (from Table 2a)						
Anchor Size, d_b							
f'_{cc} (N/mm ²)							
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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$$X_{ne} = 0.25 + 0.5 \cdot (e/h)$$

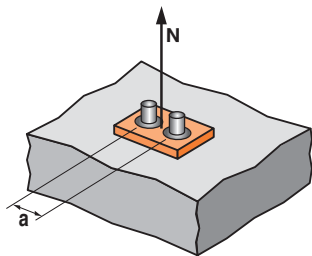
Where $e_m \leq e \leq e_c$

$$e_c = 1.5 \cdot h$$

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



$$X_{na} = 0.5 + a/(6 \cdot h)$$

Where $a_m \leq a \leq a_c$

$$a_c = 3 \cdot h$$

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}

$$\phi N_{urc} = \text{minimum of } \phi N_{ucp} \cdot X_{ncr} \cdot X_{ns} \cdot X_{nc} \cdot X_{ne} \cdot X_{na} \text{ and } \phi N_{ucc} \cdot X_{ncr} \cdot X_{ns} \cdot X_{nc} \cdot X_{ne} \cdot X_{na}$$

STEP 3

Verify anchor tensile capacity - per anchor

Table 3a Reduced characteristic ultimate steel tensile capacity, ϕN_{us} (kN) where $\phi_n = 0.67$ 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 $\phi_n = 0.58$ for ChemSet™ Anchor Stud A4/316 Stainless Steel

Checkpoint 3

Design reduced ultimate tensile capacity, ϕN_{ur}

$$\phi N_{ur} = \text{minimum of } \phi N_{urc} \text{ or } \phi N_{us}$$

Check $N^*/\phi N_{ur} \leq 1.0$,

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), $\phi = 1/1.5 = 0.67$, $f'_{cc} = 40$ N/mm²

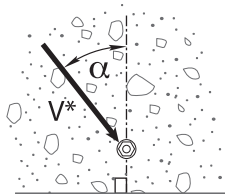
Anchor size, d_b	M10	M12	M16	M20	M24	M30
Effective depth, h (mm)	70 - 200	90 - 240	110 - 320	150 - 400	160 - 480	210 - 600
Edge distance, e_m						
40	4.3	4.7				
45			6.2			
55				9.1		
60					10.8	
90						20.0

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

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

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

For Non-cracked concrete $X_{ver} = 1.0$



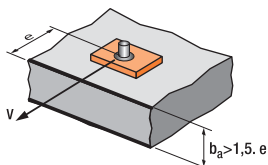
Load direction effect, conc. edge shear, X_{vd}

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

f'_{cc} (N/mm ²)	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

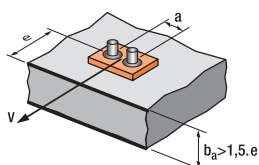


$$X_{ve} = e/e_m * \sqrt{e/e_m}$$

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

For single anchor fastening X_{ve}

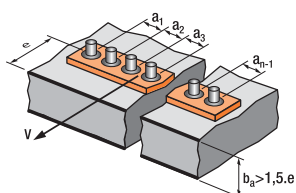
e/e_m	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
X_{ve}	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72



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

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

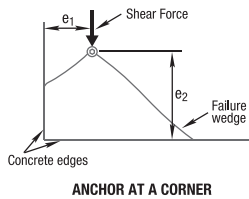
$$X_{ve} = \frac{3*e + a_1 + a_2 + a_3 + \dots + a_{n-1}}{3*n*e_m} * \sqrt{e/e_m}$$

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STRENGTH LIMIT STATE DESIGN

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


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 $\phi_v = 0.67$ 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}

$$\phi V_{ur} = \text{minimum of } \phi V_{urc} \phi V_{urcp} \phi V_{us}$$

 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

Specify - 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.