

ChemSet™ EPCON™ G5 Xtrem™

SEISMIC REINFORCING BAR - CHEMICAL INJECTION

AVAILABLE IN NEW ZEALAND ONLY

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

GENERAL INFORMATION

Performance Related



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

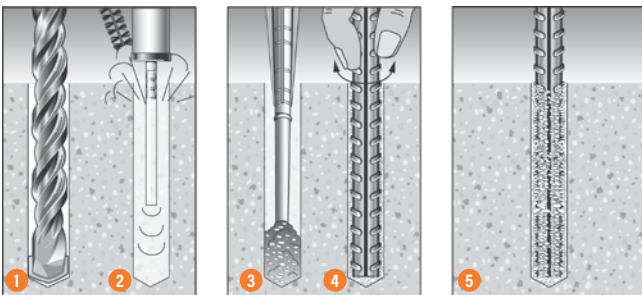
Design according to:

- AS 5216 (formerly TS101)
 - NZS 1170.5 - Earthquake Actions
 - EN 1992-4 (formerly ETAG001 Annex C, E & TR045)
 - NZS 3101 (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

- 100 year working life
- Greater productivity:**
- Anchors in dry, damp, wet or flooded holes
- Greater security:**
- Strong bond
 - Rated for sustained loading
- Versatile:**
- 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.



Principal Applications

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



Installation & Substrate Temperature Range

Minimum	Maximum
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™ Reinforcing Bar

Rebar size, d _b (mm)	Drilled hole diameter, d _h (mm)	Anchor effective depth, h (mm)	Optimum dimensions*		Concrete substrate thickness, b _n (mm)	Gr 500 Rebar - Steel		Seismic (C1) Cracked Concrete reduced characteristic tensile capacity, N _{Rd,seis} (kN) **		
								Concrete Compressive Strength, f _c		
			Anchor* spacing, a _c (mm)	Edge* distance, e _c (mm)		Tension, N _{Rd,s,seis} (kN)***	Shear, V _{Rd,s,seis} (kN)	20 MPa	30 MPa	40 MPa
12	15	110	330	165	140	43.6	8.3	19.9	23.0	23.0
16	20	125	375	188	165	77.6	14.8	24.1	29.5	34.0
20	25	170	510	255	220	121.1	23.1	38.2	46.7	54.0
25	30	210	630	315	270	189.4	36.0	52.4	64.2	74.1

All data relevant for Dry and Wet Holes. For Flooded Holes MULTIPLY N_{Rd,seis} x 0.67

* 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_{Rd,p,seis} = α_{N,seis} N_{Rk,p,seis} / γ_{Mp} where γ_{Mp} = 1.5

***Note: Seismic Cracked Concrete steel resistance, tension = N_{Rd,s,seis} = α_{N,seis} N_{Rk,s,seis} / γ_{Ms} (kN) where γ_{Ms} = 1.4 for Grade 500 Rebar

For optimised performance data, 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	12	16	20	25
Drilled Hole Dia, d _h (mm)	15	20	25	30
Stress Area, A _s (mm ²)	113	201	314	491
Yield Stress, f _{sy} (MPa)	500	500	500	500
Tensile Steel Yield Capacity, N _{sy} (kN)	56.5	100.5	157.0	245.5

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

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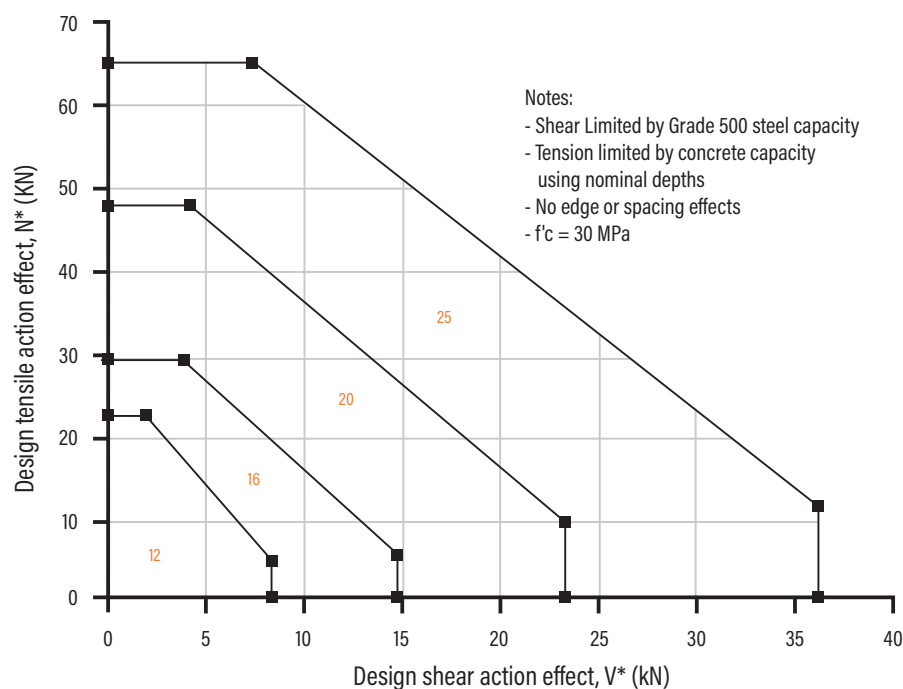
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STEP

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	12	16	20	25
Min. Anchor Spacing - a_m	50	70	85	90
Min. Edge Distance - e_m	40	45	55	60

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)

12

16 to 25

$$h + 30\text{mm} \geq 100\text{mm}$$

$$h + (2 \times d_b)$$

Checkpoint

1

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

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STRENGTH LIMIT STATE DESIGN

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STEP

2

Verify Seismic C1 cracked concrete tensile capacity - per anchor

Table 2a - Seismic (C1) Cracked concrete combined Pull-out and concrete cone resistance, tension

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

Anchor Size, d_b	C1 Seismic Data combined pull-out and concrete cone resistance $N_{Rd,p,seis}^0$				Concrete Cone Resistance - $N_{Rd,c,seis}^0$
	12	16	20	25	
Drilled Hole Dia, d_h (mm)	15	20	25	30	
Effective Depth, h (mm)	C1	C1	C1	C1	
90	18.8				18.0
100	20.9				21.1
110	23.0	32.6			24.3
120	25.1	35.5			27.7
125	26.2	37.0			29.5
140	29.3	41.5			34.9
150	31.4	44.4	54.5		38.7
160	33.5	47.4	58.1	71.9	42.7
170	35.6	50.4	61.7	76.4	46.7
180	37.7	53.3	65.4	80.9	50.9
200	41.9	59.2	72.6	89.9	59.6
210	44.0	62.2	76.3	94.4	64.2
240	50.2	71.1	87.2	107.9	78.4
280		82.9	101.7	125.9	98.8
320		94.8	116.2	143.8	120.7
350			127.1	157.3	138.1
400			145.3	179.8	168.7
450				202.3	201.3
500				224.8	235.8

Bold values are at ChemSet Rebar Anchor nominal depths

All data relevant for Dry and Wet Holes. For Flooded Holes MULTIPLY $N_{Rd,p,seis}^0 \times 0.67$ & $N_{Rd,c,seis}^0 \times 0.71$. For single anchor values: Multiply $N_{Rd,p,seis}^0 \times 1.17$ & $N_{Rd,c,seis}^0 \times 1.13$. 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 (°C)	Seis. Cat.	12	16	20	25
-40°C to +40°C	C1	1.00	1.00	1.00	1.00
-40°C to +60°C	C1	0.84	0.84	0.85	0.84
-40°C to +75°C	C1	0.26	0.26	0.26	0.257

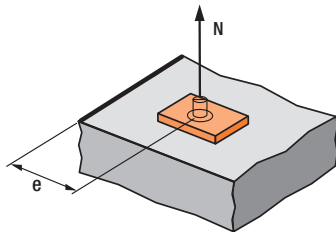
Note: X_{ns} factor only applies to $N_{Rd,p,seis}^0$ Table 2b-2 Seismic Cracked concrete compressive strength effect, tension, X_{nc}

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

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$$X_{ne} = 0.25 + 0.5 \cdot (e/h)$$

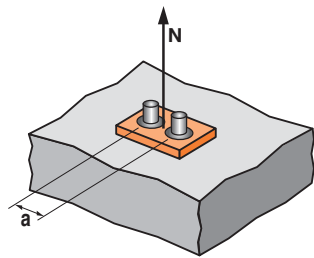
Where $e_m \leq e \leq e_c$

$$e_c = 1.5 \cdot h$$

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

Anchor size, d_b	12	16	20	25
Edge distance, e (mm)				
40	0.43			
45	0.45	0.43		
50	0.48	0.45		
55	0.50	0.47	0.41	
60	0.52	0.49	0.43	0.39
70	0.57	0.53	0.46	0.42
80	0.61	0.57	0.49	0.44
90	0.66	0.61	0.51	0.46
100	0.70	0.65	0.54	0.49
115	0.77	0.71	0.59	0.52
135	0.86	0.79	0.65	0.57
165	1.00	0.91	0.74	0.64
187		1.00	0.80	0.70
255			1.00	0.86
315				1.00



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

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

Anchor size, d_b	12	16	20	25
Edge distance, e (mm)				
50	0.58			
55	0.58			
60	0.59			
70	0.61	0.59		
85	0.63	0.61	0.58	
90	0.64	0.62	0.59	0.57
120	0.68	0.66	0.62	0.60
150	0.73	0.70	0.65	0.62
200	0.80	0.77	0.70	0.66
270	0.91	0.86	0.76	0.71
330	1.00	0.94	0.82	0.76
375		1.00	0.87	0.80
510			1.00	0.90
630				1.00

Checkpoint 2a

Design seismic cracked concrete combined pull-out and concrete cone resistance, $N_{Rd,p,seis}$

$$N_{Rd,p,seis} = N_{Rd,p,seis}^0 \cdot X_{ns} \cdot X_{nc} \cdot X_{ne} \cdot X_{na}$$

Checkpoint 2b

Design seismic cracked concrete cone resistance, $N_{Rd,c,seis}$

$$N_{Rd,c,seis} = N_{Rd,c,seis}^0 \cdot X_{nc} \cdot X_{ne} \cdot X_{na}$$

STEP 3

Verify seismic C1 cracked concrete tensile resistance - per anchor

Table 3a - Seismic C1 Cracked Concrete steel resistance, tensile, $N_{Rd,s,seis} = \alpha_{N,seis} N_{Rk,s,seis} / \gamma_{Ms}$ (kN) where $\alpha_{N,seis} = 1.0$, $\gamma_{Ms} = 1.4$ for Grade 500 Rebar

Anchor size, d_b	12	16	20	25
Rebar Gr 500	43.6	77.6	121.1	189.4

Checkpoint 3

Design seismic C1 cracked concrete tensile resistance, $N_{Rd,seis}$

$$N_{Rd,seis} = \text{minimum of } N_{Rd,p,seis}, N_{Rd,s,seis}, N_{Rd,c,seis}$$

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

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STEP 4

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

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

Anchor size, d_b	12	16	20	25
Effective depth, h (mm)	110	125	170	210
Edge distance, e_m				
40	2.9			
45		3.7		
55			5.5	
60				7.0

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

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

For single anchor fastening X_{ve}

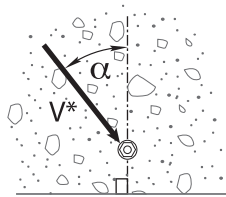
e/e_m	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
X_{ve}	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72

For 2 anchors fastening X_{ve}

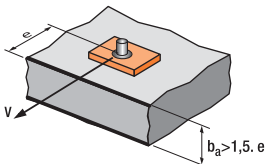
e/e_m	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
a/e_m												
1.0	0.67	0.84	1.03	1.22	1.43	1.65	1.88	2.12	2.36	2.62	2.89	3.16
1.5	0.75	0.93	1.12	1.33	1.54	1.77	2.00	2.25	2.50	2.76	3.03	3.31
2.0	0.83	1.02	1.22	1.43	1.65	1.89	2.12	2.38	2.63	2.90	3.18	3.46
2.5	0.92	1.11	1.32	1.54	1.77	2.00	2.25	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

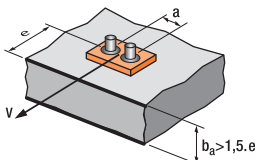
$$X_{ve} = \frac{3 \cdot e + a_1 + a_2 + a_3 + \dots + a_{n-1}}{3 \cdot n \cdot e_m} \cdot \sqrt{e/e_m}$$



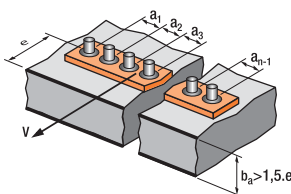
Load direction effect,
conc. edge shear, X_{vd}



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



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



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

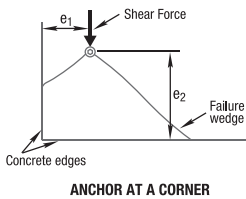
Anchor size, d_b		12	16	20	25
Effective depth, h (mm)		110	125	170	210
-40°C to +40°C	C1	40.6	58.9	93.5	128.3
-40°C to +60°C	C1	34.1	54.9	92.6	128.3
-40°C to +75°C	C1	10.6	17.0	28.3	42.8

All data relevant for Dry and Wet Holes. For Flooded Holes MULTIPLY $N_{Rd,p,seis}^0 \times 0.67$

For single anchor values: Multiply $V_{Rd,cp,seis}^0 \times 1.13$

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 seismic cracked concrete edge shear resistance,

$$V_{Rd,c,seis} = V_{Rd,c,seis}^0 * X_{vc} * X_{vd} * X_{ve} * X_{vs}$$

Checkpoint 4b

Design seismic cracked concrete Pryout failure,

$$V_{Rd,cp,seis} = V_{Rd,cp,seis}^0 * X_{nc} * X_{ne} * X_{na}$$

STEP 5

Verify seismic C1 cracked concrete shear resistance - per anchor

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

where $\alpha_{V,seis} = 0.85$ and $\gamma_{Ms} = 1.5$

Anchor size, d_b	C1 Seismic Data			
	12	16	20	25
Rebar Gr 500	8.3	14.8	23.1	36.0

For single anchor values: Multiply $V_{Rd,c,seis}^0 \times 1.17$

Checkpoint 5

Design seismic C1 cracked concrete shear resistance, $V_{Rd,seis}$

$$V_{Rd,seis} = \text{minimum of } V_{Rd,c,seis}, V_{Rd,cp,seis}, V_{Rd,s,seis}$$

Check $V^*/V_{Rd,seis} \leq 1$,

if not satisfied return to step 1

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STEP

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Combined Loading

Checkpoint

6

Check

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

Specify - Reinforcing Bar Anchorage

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

Example

Ramset™ ChemSet™ EPCON™ G5 with
20mm grade 500 Rebar
Drilled hole depth to be 170 mm.
To be installed in accordance with
Ramset™ Installation Instructions.

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