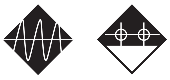
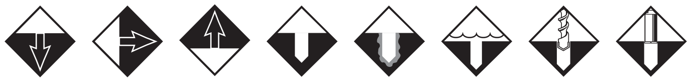
Ramset™

AVAILABLE IN NEW ZEALAND ONLY **(Australia refer to ChemSet™ Reo 502™)**

17.1 GENERAL INFORMATION

PERFORMANCE RELATED	INSTALLATION RELATED
	

Product

Epcon C6 is a versitile pure epoxy anchoring adhesive

Benefits, Advantages and Features

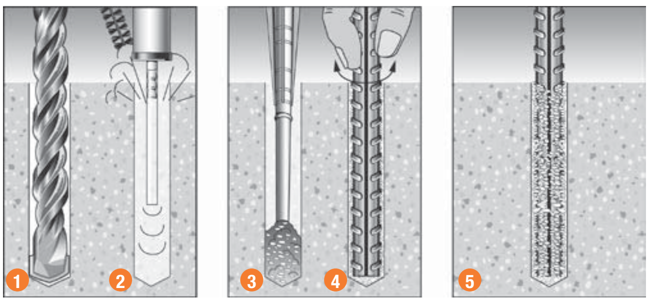
Features

- Superior strength in shallow embedment.
- Close to edge, stress free anchoring.
- Suitable for use with zinc plated, hot dipped galvanized or stainless steel Chemset Anchor Studs.
- Resistant to cyclic loading and vibration.
- Resistant to alkaline conditions.
- Suitable for use in core drilled holes.
- Superior strength with grade 5.8 steel Chemset Anchor Studs.
- Suitable for underwater installations.

Principal Applications

- Structural beams and columns
- Batten fixing
- Installing, handrails, balustrades and gates
- Racking
- Safety barriers
- Stadium seating
- Machinery and heavy plant hold down

Installation



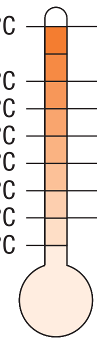
1. Drill recommended diameter and depth hole.
2. **Important:** Use **Ramset™** Dustless Drilling System to ensure holes are clean. Alternatively, clean dust and debris from hole with stiff wire or nylon brush and blower in the following sequence: blow x 4, brush x 3, blow x 4, brush x 3, blow x 4.
3. Insert mixing nozzle to bottom of hole. Fill hole to 3/4 the hole depth slowly, ensuring no air pockets form.
4. Insert **Ramset™** ChemSet™ Anchor Stud/rebar to bottom of hole while turning.
5. Allow to cure as per setting times.

Installation temperature limits:

- Substrate: 5°C to 40°C.
- Mortar: 15°C to 35°C.

Load should not be applied to anchor until the chemical has sufficiently cured as specified.

Approximate Setting Times



Substrate Temperature	Epcon C6 Gel Time (mins)	Epcon C6 Loading Time (hrs)
40°C	-	-
30°C	11	2
25°C	15	2.5
20°C	20	3
15°C	32	6
10°C	45	12
5°C	60	24
0°C		

Note: Cartridge temperature minimum 15°C.

Note: Cure time extended in flooded conditions. Refer to technical data sheet.

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Installation and performance details: Epcon™ C6 and Reinforcing Bar

Anchor Size, d_b (mm)	Drilled Hole diam., d_h (mm)	Anchor Effective Depth, h (mm)	Optimum dimensions*			Reduced Characteristic Capacity #				
			Edge* distance, e_c (mm)	Anchor spacing, a_c (mm)	Concrete substrate thickness, b_m (mm)	Gr 500 Rebar - Steel		Concrete		
						Tension, $ØN_{us}$ (kN)***	Shear, $ØV_{us}$ (kN)	Tension, $ØN_{uc}$ (kN)** Concrete compressive strength, f'c		
								20 MPa	32 MPa	40 MPa
10	14	90	40	60	120	31.4	21.4	14.8	18.7	20.9
12	16	110	50	70	140	45.2	30.8	21.7	27.4	30.7
16	20	125	65	100	160	80.4	54.8	32.9	41.6	46.5
20	25	150	80	120	190	125.6	85.7	49.3	62.4	69.7
		170			220			55.9	70.7	79.0
24	30	180	100	145	240	180.8	123.3	71.0	89.8	100.4
		210			270			82.8	104.8	117.2
25	32	180	100	150	240	196.4	133.9	74.0	93.6	104.6
		210			270			86.3	109.2	122.0
32	40	240	130	195	320	321.6	219.3	126.2	159.7	178.5
		300			380			157.8	199.6	223.2

* 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: Reduced characteristic ultimate concrete tensile capacity = $ØN_{uc}$ where Ø = 0.60 and N_{uc} = Characteristic ultimate concrete tensile capacity. **For conversion to Working Load Limit MULTIPLY $ØN_{uc}$ x 0.55
***Note: Reduced characteristic ultimate steel tensile capacity = $ØN_{us}$ where Ø = 0.8 and N_{us} = Characteristic ultimate steel tensile capacity. **For conversion to Working Load Limit MULTIPLY $ØN_{us}$ x 0.56**
#Note: Design Tensile Capacity $ØN_{ur}$ = minimum of $ØN_{uc}$ and $ØN_{us}$
WET HOLES: Multiply $ØN_{uc}$ x 0.7

17.2 DESCRIPTION AND PART NUMBERS

Description	Cartridge Size	Part No.
Epcon™ C6EF	450 ml	C6EF-450
Epcon™ C6 Nozzles	-	ISNE
Dispensing Tool	-	E108

Effective depth, h (mm)

$h \geq 6 * d_h$

(To obtain full steel strength in shear)

Substrate thickness, b_m (mm)

b_m = greater of: 1.25 x h,
h + (2 x d_h)

Drilled hole depth, h_1 (mm)
h_1 = h
h = Effective depth

17.3 ENGINEERING PROPERTIES

Typical Engineering Properties of Grade 500 Reinforcing Bar

Rebar Size	10	12	16	20	24	25	32
Drilled Hole Dia, d_h (mm)	14	16	20	25	30	30	40
Stress Area, A_s (mm^2)	78.5	113	201	314	452	491	804
Yield Stress, f_{sy} (MPa)	500	500	500	500	500	500	500
Tensile Steel Yield Capacity N_{sy}, (KN)	39.3	56.5	100.5	157.0	226.0	245.5	402.0

For further information refer to reinforcing bar manufacturer's published information and AS/NZS 4671:2001

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STEP 1 Select anchor to be evaluated

Table 1a Indicative combined loading – interaction diagram

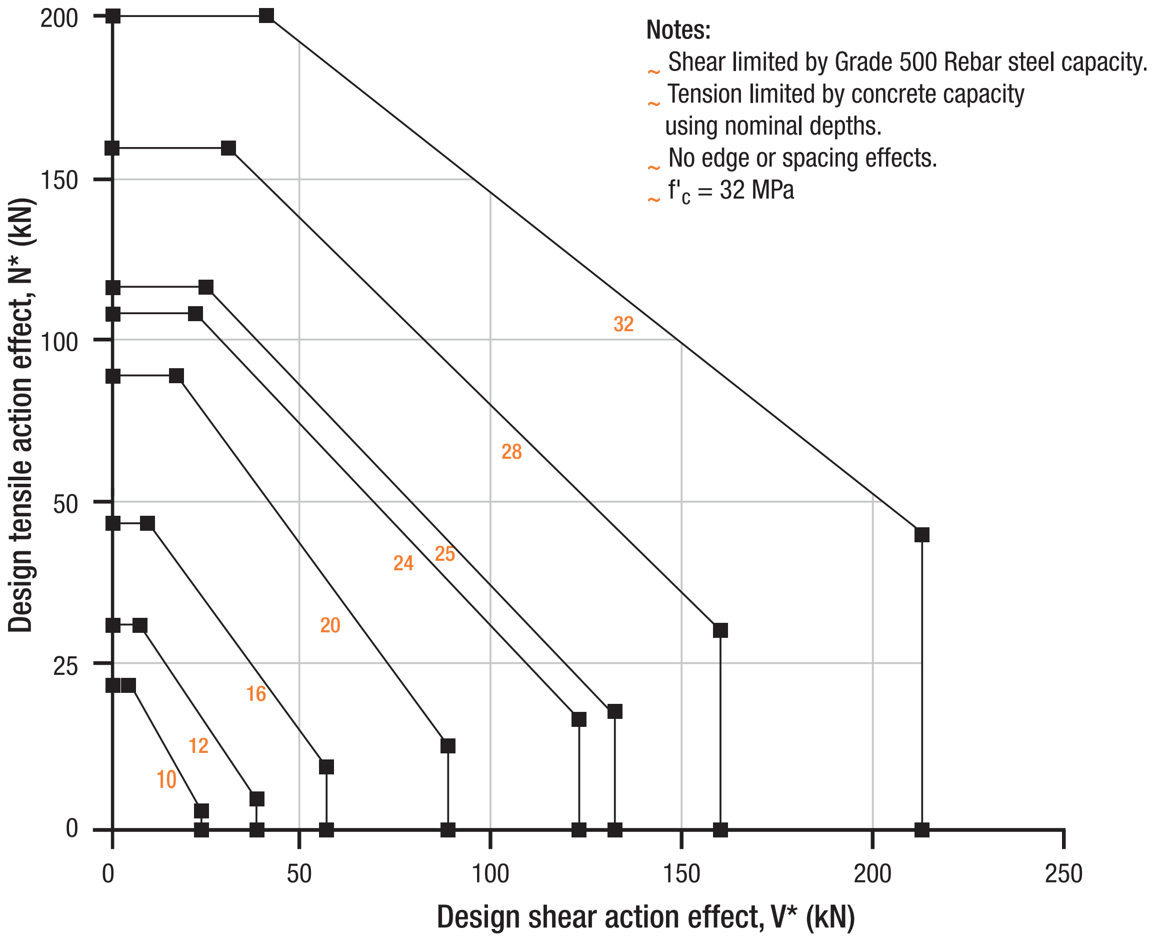

Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

Anchor size, d_b	10	12	16	20	24	25	32
e_m, a_m	30	36	48	60	72	75	96

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

Refer to nominal recommended effective depths, h, listed in installation and performance details table on page 128.

Effective depth, h (mm)

$h \geq 6 * d_h$

(To obtain full steel strength in shear)

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

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STEP 2 Verify concrete tensile capacity - per anchor

Table 2a Reduced characteristic ultimate concrete tensile capacity, $ØN_{uc}$ (kN), $Ø_c$ = 0.6, f'_c = 32 MPa

Anchor size, d_b	10	12	16	20	24	25	32
Drilled Hole Dia, d_h (mm)	14	16	20	25	30	30	40
Effective Depth, h (mm)							
85	17.7						
90	**18.7**						
95	19.8						
100	20.8	25.0					
105	21.8	26.2					
110	22.9	**27.4**					
115	23.9	28.7					
125	26.0	31.2	**41.6**				
140	29.1	34.9	46.6				
150	31.2	37.4	49.9	62.4			
170		42.4	56.6	**70.7**			
180		44.9	59.9	74.9	89.8	93.6	
210			69.9	87.3	**104.8**	**109.2**	
240			79.8	99.8	119.8	124.8	159.7
270				112.3	134.7	140.4	179.6
300				124.8	149.7	155.9	**199.6**
320				133.1	159.7	166.3	212.9
330					164.7	171.5	219.6
360					179.6	187.1	239.5
420						218.3	279.5
460							306.1
500							332.7

Bold values are at ChemSet™ Anchor Stud nominal depths.
Note: Effective depth, h must be ≥ 6 x drilled hole diameter, d_h for anchor to achieve tabled shear capacities. **Wet holes: Multiply $ØN_{uc}$ x 0.7**

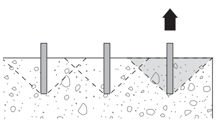
Table 2b-1 Service temperature effect, tension, X_{ns}

Service Temp °C	<45	50	55	60	65	70	>70
X_{ns}	1.00	0.97	0.87	0.78	0.68	0.58	N/A

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

f'_c (MPa)	20	25	32	40	50
X_{nc}	0.79	0.88	1.00	1.12	1.25

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



Anchor size, d_b	10	12	16	20	24	25	32
Edge Distance, e (mm)							
30	0.83						
35	0.91	0.81					
40	1.00	0.88					
50		1.00	0.85				
65			1.00	0.87			
80				1.00	0.88	0.86	
95					1.00	0.97	0.82
100						1.00	0.85
110							0.90

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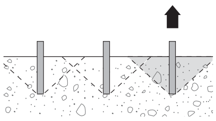

Table 2d Anchor spacing effect, end of a row, tension, X_{nae}

For single anchor design, X_{nae} = 1.0

Anchor size, d_b	10	12	16	20	24	25	32
Anchor Spacing, a (mm)							
30	0.75						
35	0.79	0.74					
40	0.83	0.78					
50	0.92	0.85	0.76				
60	1.00	0.92	0.81	0.75			
75		1.00	0.89	0.81	0.76	0.75	
95			1.00	0.90	0.83	0.82	
120				1.00	0.92	0.90	0.81
140					1.00	0.97	0.86
150						1.00	0.89
170							0.94
195							1.00

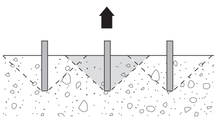

Table 2e Anchor spacing effect, internal to a row, tension, X_{nai}

For single anchor design, X_{nai} = 1.0

Anchor size, d_b	10	12	16	20	24	25	32
Anchor Spacing, a (mm)							
30	0.50						
35	0.58	0.49					
40	0.67	0.56					
50	0.83	0.69	0.52				
60	1.00	0.83	0.63	0.50			
75		1.00	0.78	0.63	0.52	0.50	
95			1.00	0.79	0.66	0.63	0.49
120				1.00	0.83	0.80	0.63
150					1.00	1.00	0.78
170							0.89
195							1.00

Checkpoint 2

Design reduced ultimate concrete tensile capacity, $ØN_{urc}$

$$ØN_{urc} = ØN_{uc} * X_{ns} * X_{nc} * X_{ne} * (X_{nae} \text{ or } X_{nai})$$

STEP 3 Verify anchor tensile capacity - per anchor

Table 3a Reduced characteristic ultimate steel tensile capacity, $ØN_{us}$ (kN), $Ø_n$ = 0.8

Anchor size, d_b	10	12	16	20	24	25	32
Grade 500 Rebar	31.4	45.2	80.4	125.6	180.8	196.4	321.6

Step 3b Reduced characteristic ultimate bolt steel tensile capacity, $ØN_{tf}$ (kN)

Not appropriate for this product.

Checkpoint 3

Design reduced ultimate tensile capacity, $ØN_{ur}$

$ØN_{ur}$ = minimum of $ØN_{urc}$, $ØN_{us}$

Check $N^* / ØN_{ur} \leq 1$,

if not satisfied return to step 1

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Tensile performance conversion table

Performance Required	Concrete Tensile Performance		Steel Tensile Performance	
	Notation	Concrete Tension Capacity	Notation	Carbon Steel Tension Capacity
Strength Limit State	$ØN_{urc}$	MULTIPLY $ØN_{urc}$ x 1.00	$ØN_{us}$	MULTIPLY $ØN_{us}$ x 1.00
Working Load Limit	N_{ac}	MULTIPLY $ØN_{urc}$ x 0.55	N_{as}	MULTIPLY $ØN_{us}$ x 0.56
Cyclic Loading	N_{yc}	MULITPLY $ØN_{urc}$ x 0.55	N_{ys}	MULITPLY $ØN_{us}$ x 0.56
Fire Resistance	$N_{Rk,c,fi,t}$	Refer to pages 238-257	$N_{Rk,s,fi,t}$	Refer to pages 238-257
Cracked Concrete/Tension Zone	$N^0_{Rd,p}$	Refer to pages 258-298	$N_{Rd,s}$	Refer to pages 258-298
Seismic	$N^0_{Rd,p,sis}$	Refer to pages 299-325	$N_{Rd,s,sis}$	Refer to pages 299-325

NOTE: Design Tensile Capacity is the minimum of Concrete Tension and Steel Tension Capacities

STEP 4 Verify concrete shear capacity - per anchor

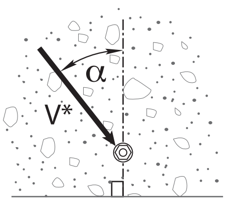
Table 4a Reduced characteristic ultimate concrete edge shear capacity, $ØV_{uc}$ (kN), $Ø_q$ = 0.6, f'_c = 32 MPa

Anchor size, d_b	10	12	16	20	24	25	32
Edge Distance, e (mm)							
30	2.5						
35	3.2						
40	3.9	4.2					
50	5.5	5.9	6.5				
60	7.2	7.7	8.6	9.6			
75	10.1	10.8	12.0	13.4	14.7	14.7	
95	14.3	15.3	17.1	19.2	21.0	21.0	
120	20.4	21.8	24.3	27.2	29.8	29.8	34.4
200	43.8	46.8	52.4	58.6	64.1	64.1	74.1
300	80.5	86.1	96.2	107.6	117.8	117.8	136.1
400	123.9	132.5	148.1	165.6	181.4	181.4	209.5
500	173.2	185.2	207.0	231.5	253.6	253.6	292.8
600	227.7	243.4	272.2	304.3	333.3	333.3	384.9

Note: Effective depth, h must be ≥ 6 x drilled hole diameter, d_h for anchor to achieve tabled shear capacities.

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

f'_c (MPa)	20	25	32	40	50
X_{vc}	0.79	0.88	1.00	1.12	1.25



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

Table 4c Load direction effect, concrete edge shear, X_{vd}

Angle, α°	0	10	20	30	40	50	60	70	80	90 - 180
X_{vd}	1.00	1.04	1.16	1.32	1.50	1.66	1.80	1.91	1.98	2.00

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Table 4d Anchor spacing effect, concrete edge shear, X_{va}

Note: For single anchor designs, $X_{va} = 1.0$

Edge distance, e (mm)	25	30	35	50	60	75	125	200	300	400	500	600
Anchor spacing, a (mm)												
25	0.70	0.67	0.64	0.60	0.58	0.57	0.54					
30	0.74	0.70	0.67	0.62	0.60	0.58	0.55	0.53				
35	0.78	0.73	0.70	0.64	0.62	0.59	0.56	0.54	0.52			
50	0.90	0.83	0.79	0.70	0.67	0.63	0.58	0.55	0.53	0.53		
60	0.98	0.90	0.84	0.74	0.70	0.66	0.60	0.56	0.54	0.53	0.52	
75	1.00	1.00	0.93	0.80	0.75	0.70	0.62	0.58	0.55	0.54	0.53	0.53
150			1.00	1.00	1.00	0.90	0.74	0.65	0.60	0.58	0.56	0.55
200						1.00	0.82	0.70	0.63	0.60	0.58	0.57
300							0.98	0.80	0.70	0.65	0.62	0.60
400							1.00	0.90	0.77	0.70	0.66	0.63
500								1.00	0.83	0.75	0.70	0.67
625									0.92	0.81	0.75	0.71
750									1.00	0.88	0.80	0.75
875										0.94	0.85	0.79
1000										1.00	0.90	0.83
1250											1.00	0.92
1500												1.00

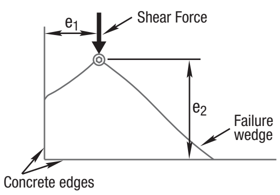
Table 4e Multiple anchors effect, concrete edge shear, X_{vn}

Note: For single anchor designs, $X_{vn} = 1.0$

Anchor spacing / Edge distance, a / e	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00	2.25	2.50
Number of anchors, n												
2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	0.72	0.76	0.80	0.83	0.86	0.88	0.91	0.93	0.95	0.96	0.98	1.00
4	0.57	0.64	0.69	0.74	0.79	0.82	0.86	0.89	0.92	0.94	0.97	1.00
5	0.49	0.57	0.63	0.69	0.74	0.79	0.83	0.87	0.90	0.93	0.97	1.00
6	0.43	0.52	0.59	0.66	0.71	0.77	0.81	0.85	0.89	0.93	0.96	1.00
7	0.39	0.48	0.56	0.63	0.69	0.75	0.80	0.84	0.88	0.92	0.96	1.00
8	0.36	0.46	0.54	0.61	0.68	0.74	0.79	0.84	0.88	0.92	0.96	1.00
9	0.34	0.44	0.52	0.60	0.67	0.73	0.78	0.83	0.87	0.91	0.96	1.00
10	0.32	0.42	0.51	0.59	0.66	0.72	0.77	0.82	0.87	0.91	0.96	1.00
15	0.26	0.37	0.47	0.55	0.63	0.70	0.76	0.81	0.86	0.90	0.95	1.00
20	0.23	0.35	0.45	0.54	0.61	0.68	0.75	0.80	0.85	0.90	0.95	1.00

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

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



ANCHOR AT A CORNER

Edge distance, e_2 (mm)	25	30	35	50	60	75	125	200	300	400	600	900
Edge dustance, 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

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Checkpoint 4

Design reduced ultimate concrete edge shear capacity, $ØV_{urc}$

$$ØV_{urc} = ØV_{uc} * X_{vc} * X_{vd} * X_{va} * X_{vn} * X_{vs}$$

STEP 5 Verify anchor shear capacity - per anchor

Table 5a Reduced characteristic ultimate steel shear capacity, $ØV_{us}$ (kN), $Ø_v$ = 0.8

Anchor size, d_b	10	12	16	20	24	25	32
Grade 500 Rebar	21.4	30.8	54.8	85.7	123.3	133.9	219.3

Step 5b Reduced characteristic ultimate bolt steel shear capacity, $ØV_{sf}$ (kN)

Not appropriate for this product.

Checkpoint 5

Design reduced ultimate shear capacity, $ØV_{ur}$

$ØV_{ur}$ = minimum of $ØV_{urc}$, $ØV_{us}$

Check $V^* / ØV_{ur} \leq 1$,

if not satisfied return to step 1

Shear performance conversion table

Performance Required	Concrete Shear Performance		Steel Shear Performance	
	Notation	Concrete Shear Capacity	Notation	Carbon Steel Shear Capacity
Strength Limit State	$ØV_{uc}$	MULTIPLY $ØV_{uc}$ x 1.00	$ØV_{us}$	MULTIPLY $ØV_{us}$ x 1.00
Working Load Limit	V_{ac}	MULTIPLY $ØV_{uc}$ x 0.55	V_{as}	MULTIPLY $ØV_{us}$ x 0.45
Cyclic Loading	V_{yc}	MULITPLY $ØV_{uc}$ x 0.55	V_{ys}	MULITPLY $ØV_{us}$ x 0.45
Fire Resistance	$V_{Rk,c,fi,t}$	Refer to pages 238-257	$V_{Rk,s,fi,t}$	Refer to pages 238-257
Cracked Concrete/Tension Zone	$V^0_{Rd,c}$	Refer to pages 258-298	$V^0_{Rd,s}$	Refer to pages 258-298
Seismic	$V^0_{Rd,c,sis}$	Refer to pages 299-325	$V^0_{Rd,s,sis}$	Refer to pages 299-325

NOTE: Design Shear Capacity is the minimum of Concrete Shear and Steel Shear Capacities

STEP 6 Combined loading and specification

Checkpoint 6

Check

$$N^*/ØN_{ur} + V^*/ØV_{ur} \leq 1.2,$$

if not satisfied return to step 1

Specify – Reinforcing Bar Anchorage

Ramset™ Epcon™ C6 with (Anchor Size) grade 500 Rebar.
Drilled hole depth to be (h) mm.

Example

Ramset™ Epcon™ C6 with
N20 grade 500 Rebar
Drilled hole depth to be 160 mm.
To be installed in accordance with Ramset™ Technical Data Sheet.