

### 12.1 GENERAL INFORMATION

PERFORMANCE RELATED	MATERIAL SPECIFICATION	INSTALLATION RELATED

#### Product

ChemSet™ Injection 101 PLUS is a marine grade polyester adhesive anchor.

#### Benefits, Advantages and Features

- Certified Performance European Technical Approval ETAG 001-5 Option 7

#### Fast installation:

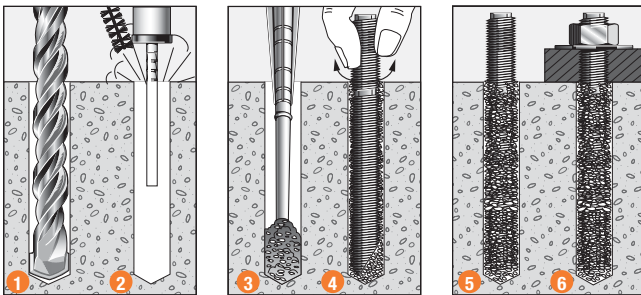
- Load in 50 minutes (at 20°C)
- Easy cold weather dispensing

#### Versatile:

- Suitable for anchoring into a wide variety of substrates
- Solid concrete, hollow block and brick
- Flooded holes
- Styrene Free
- Cold and temperate climates
- VOC Compliant

#### Australian Made

#### 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. ChemSet™ Injection to cure as per setting times.
6. Attach fixture.



### Principal Applications

- Hollow brick and block
- Stadium seating
- Starter bars
- Balustrades

#### Installation temperature limits:

- Substrate: 0°C to 40°C.
- Adhesive: 5°C to 40°C.

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

#### Service temperature limits:

-40°C to 80°C.

#### Setting Times

Substrate Temperature	101 PLUS	
	Gel Time (mins)	Loading Time (mins)
30°C	4	35
25°C	5	40
20°C	6	50
10°C	10	85
5°C	18	145

Note: Cartridge temperature minimum 5°C.

**Installation and performance details:  
ChemSet™ Injection 101 PLUS and ChemSet™ Anchor Studs**

Anchor size, d <sub>b</sub> (mm)	Drilled hole diameter, d <sub>h</sub> (mm)	Fixture hole diameter, d <sub>f</sub> (mm)	Anchor effective depth, h (mm)	Tightening torque, T <sub>r</sub> (Nm)	Optimum dimensions*		
					Edge distance, e <sub>c</sub> (mm)	Anchor spacing, a <sub>c</sub> (mm)	Concrete substrate thickness, b <sub>m</sub> (mm)
M8	10	10	80	10	35	50	100
M10	12	12	90	20	40	60	120
M12	14	15	110	40	50	75	140
M16	18	20	125	95	65	100	160
M20	24	24	150	180	80	120	190
			170				220
M24	26	28	160	315	100	145	200
			210				270

\* 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 <sub>b</sub> (mm)	Reduced Characteristic Capacity#														
	Grade 5.8 Steel Studs		Grade 8.8 Steel Studs		AISI 316 Stainless Steel Studs		Concrete								
	Shear, ØV <sub>us</sub> (kN)	Tension, ØN <sub>us</sub> (kN)***	Shear, ØV <sub>us</sub> (kN)	Tension, ØN <sub>us</sub> (kN)***	Shear, ØV <sub>us</sub> (kN)	Tension, ØN <sub>us</sub> (kN)**	Tension, ØN <sub>uc</sub> (KN)**								
							Concrete Compressive Strength, f <sub>c</sub>								
						20 MPa			32 MPa			40 MPa			
M8	8.9	14.3	14.5	23.4	10.7	14.9	6.1	8.2	9.3						
M10	14.1	22.7	23.0	37.1	17.0	23.8	8.0	10.8	12.2						
M12	21.0	33.8	33.5	54.0	25.3	35.3	11.5	15.5	17.5						
M16	39.7	64.7	62.3	100.5	49.6	69.3	17.9	24.2	27.3						
M20	59.9	97.6	97.2	156.8	74.9	104.6	29.7	40.1	45.3						
							33.6	45.4	51.3						
M24	86.8	141.3	140.1	225.9	108.5	151.4	43.5	58.8	66.4						
							57.1	77.2	87.2						

\* 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<sub>uc</sub> where Ø = 0.6 and N<sub>uc</sub> = Characteristic ultimate concrete tensile capacity. For conversion to Working Load Limit MULTIPLY ØN<sub>uc</sub> x 0.55

\*\*\*Note: Reduced characteristic ultimate steel tensile capacity = ØN<sub>us</sub> where Ø = 0.8 and N<sub>us</sub> = Characteristic ultimate carbon steel tensile capacity. For conversion to Working Load Limit MULTIPLY ØN<sub>us</sub> x 0.45

#Note: Design Tensile Capacity ØN<sub>ur</sub> = minimum of ØN<sub>uc</sub> and ØN<sub>us</sub>

WET HOLES: Multiply ØN<sub>uc</sub> x 1

## 12.2 DESCRIPTION AND PART NUMBERS

Description	Cartridge Size	Part No.
ChemSet™ 101 PLUS Cartridge	380 ml	C101C
ChemSet™ 101 PLUS Jumbo Cartridge	750 ml	C101J
ChemSet™ 101 PLUS Kit	2 x 380 ml	ISKP
Mixer Nozzle for 101 PLUS	-	ISNP

**Effective depth, h (mm)**

Preferred  $h = h_n$  otherwise,

$h = L_e - t$

$h \geq 6 * d_h$

**t = total thickness of material(s) being fastened.**

**Substrate thickness, b<sub>m</sub> (mm)**

**b<sub>m</sub> = greater of: 1.25 x h, h + (2 x d<sub>h</sub>)**

**Drilled hole depth, h<sub>1</sub> (mm)**

**h<sub>1</sub> = h**

**h = Effective depth**

## 12.3 ENGINEERING PROPERTIES

Refer to "Engineering Properties" for ChemSet™ Anchor Studs on page 43.

**STEP 1** Select anchor to be evaluated

Table 1a Indicative combined loading – interaction diagram

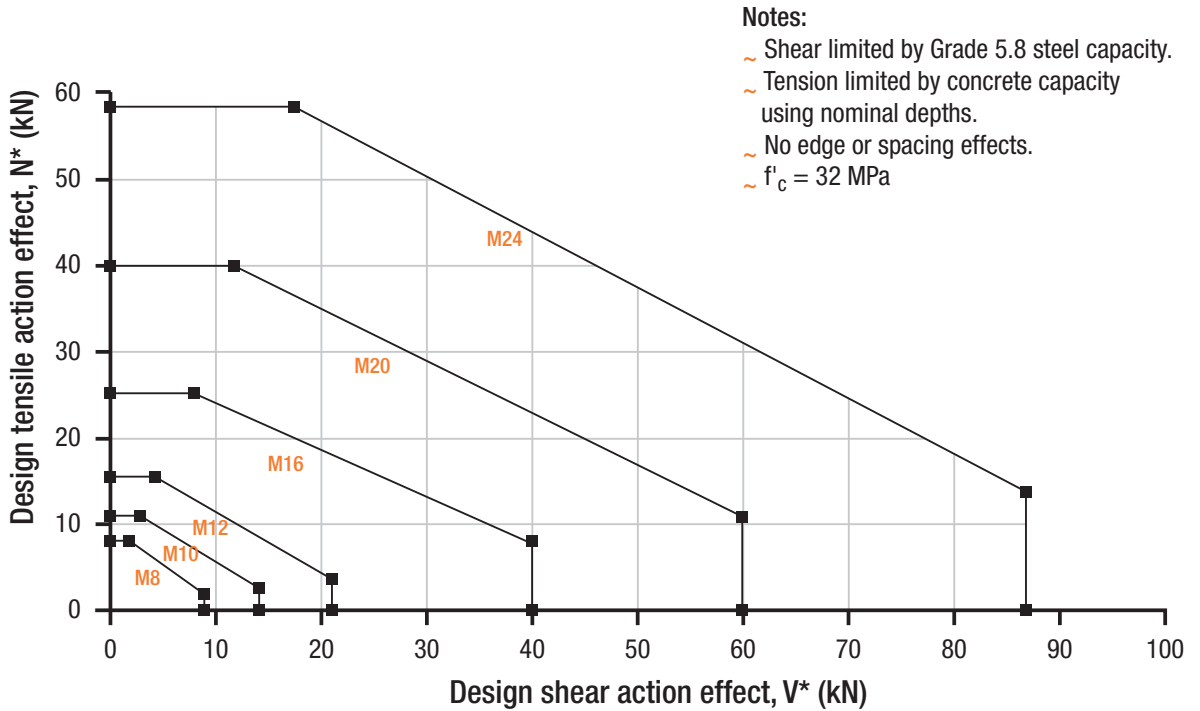


Table 1b Absolute minimum edge distance and anchor spacing values,  $e_m$  and  $a_m$  (mm)

Anchor size, $d_b$	M8	M10	M12	M16	M20	M24
$e_m, a_m$	25	30	35	50	60	75

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

Refer to "Description and Part Numbers" table for either ChemSet™ Anchor Studs on page 43.

Effective depth,  $h$  (mm)

Preferred  $h = h_n$  otherwise,

$h = L_e - t$

$h \geq 6 * d_b$

$t$  = total thickness of material(s) being fastened.

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

**STEP 2** Verify concrete tensile capacity - per anchor

Table 2a Reduced characteristic ultimate concrete tensile capacity,  $\phi N_{uc}$  (kN),  $\phi_c = 0.60$ ,  $f'_c = 32$  MPa

Anchor size, $d_b$	M8	M10	M12	M16	M20	M24
Drilled hole dia., $d_h$ (mm)	10	12	14	18	24	26
Effective depth, $h$ (mm)						
60	6.1					
70	7.2	8.4				
80	<b>8.2</b>	9.6				
90		<b>10.8</b>	12.7			
100		12.0	14.1			
110			<b>15.5</b>	21.3		
120			16.9	23.3		
125			17.6	<b>24.2</b>		
140			19.7	27.1	37.4	
150					<b>40.1</b>	55.2
160					42.7	<b>58.8</b>
170					45.4	62.5
180					48.1	66.2
190					50.7	69.9
200					53.4	73.5
210						77.2
220						80.9
230						84.6
240						88.2

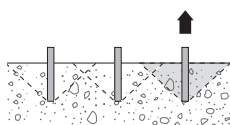
Bold values are at ChemSet™ Anchor Stud nominal depths.

Note: Effective depth,  $h$  must be  $\geq 6 \times$  drilled hole diameter,  $d_h$ , for anchor to achieve tabled shear capacities. **WET HOLES: Multiply  $\phi N_{uc} \times 1$**

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

$f'_c$ (MPa)	20	25	32	40	50
$X_{nc}$	0.74	0.86	1.00	1.13	1.27

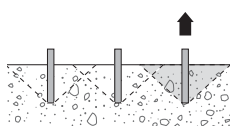
Table 2c Edge distance effect, tension,  $X_{ne}$



Anchor size, $d_b$	M8	M10	M12	M16	M20	M24
Edge distance, $e$ (mm)						
25	0.85					
30	0.96	0.83				
35	1	0.91	0.81			
40		1	0.88			
50			1	0.85		
60				0.96	0.83	
65				1	0.87	
75					0.96	0.85
80					1	0.88
100						1

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

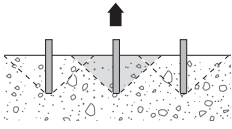
For single anchor design,  $X_{nae} = 1.0$



Anchor size, $d_b$	M8	M10	M12	M16	M20	M24
Anchor spacing, $a$ (mm)						
25	0.76					
30	0.81	0.75				
35	0.86	0.79	0.74			
40	0.92	0.83	0.78			
50	1	0.92	0.85	0.76		
60		1	0.92	0.81	0.75	
75			1	0.89	0.81	0.76
100				1	0.92	0.85
120					1	0.92
150						1

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

For single anchor design,  $X_{nai} = 1.0$



Anchor size, $d_b$	M8	M10	M12	M16	M20	M24
Anchor spacing, $a$ (mm)						
25	0.52					
30	0.63	0.50				
35	0.73	0.58	0.49			
40	0.83	0.67	0.56			
50	1	0.83	0.69	0.52		
60		1	0.83	0.63	0.50	
75			1	0.78	0.63	0.52
100				1	0.83	0.69
120					1	0.83
150						1

**Checkpoint 2**

Design reduced ultimate concrete tensile capacity,  $\phi N_{urc}$

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

**STEP 3**

**Verify anchor tensile capacity - per anchor**

**Table 3a Reduced characteristic ultimate steel tensile capacity,  $\phi N_{us}$  (kN),  $\phi_n = 0.8$**

Anchor size, $d_b$	M8	M10	M12	M16	M20	M24
ChemSet™ Anchor Stud Grade 5.8 Carbon Steel	14.3	22.7	33.8	64.7	97.6	141.3
ChemSet™ Anchor Stud A4/316 Stainless Steel	14.9	23.8	35.3	69.3	104.6	151.4
Typical Threaded Rod Grade 8.8 Carbon Steel	23.4	37.1	54.0	100.5	156.8	225.9

**Step 3b Reduced characteristic ultimate bolt steel tensile capacity,  $\phi N_{tr}$  (kN)**

Not appropriate for this product.

**Checkpoint 3**

Design reduced ultimate tensile capacity,  $\phi N_{ur}$

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

$$\text{Check } N^* / \phi N_{ur} \leq 1,$$

if not satisfied return to step 1

**Tensile performance conversion table**

Performance Required	Concrete Tensile Performance		Steel Tensile Performance		
	Notation	Concrete Tension Capacity	Notation	Carbon Steel Tension Capacity	Stainless Steel Tension Capacity
Strength Limit State	$\phi N_{urc}$	MULTIPLY $\phi N_{urc}$ x 1.00	$\phi N_{us}$	MULTIPLY $\phi N_{us}$ x 1.00	MULTIPLY $\phi N_{us}$ x 1.00
Working Load Limit	$N_{ac}$	MULTIPLY $\phi N_{urc}$ x 0.55	$N_{as}$	MULTIPLY $\phi N_{us}$ x 0.45	MULTIPLY $\phi N_{us}$ x 0.50
Cyclic Loading	$N_{yc}$	Refer to page 40 for suitable anchor	$N_{ys}$	Refer to page 40 for suitable anchor	Refer to page 40 for suitable anchor
Fire Resistance	$N_{Rk,c,fi,t}$	Refer to pages 238-257	$N_{Rk,s,fi,t}$	Refer to pages 238-257	Refer to pages 238-257
Cracked Concrete/Tension Zone	$N_{Rd,p}^0$	Refer to pages 258-298	$N_{Rd,s}$	Refer to pages 258-298	Refer to pages 258-298
Seismic	$N_{Rd,p,sis}^0$	Refer to pages 299-325	$N_{Rd,s,sis}$	Refer to pages 299-325	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

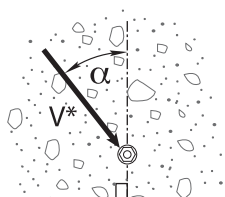
Table 4a Reduced characteristic ultimate concrete edge shear capacity,  $\phi V_{uc}$  (kN),  $\phi_1 = 0.6$ ,  $f'_c = 32$  MPa

Anchor size, $d_b$	M8	M10	M12	M16	M20	M24
Edge distance, $e$ (mm)						
25	1.6					
30	2.2	2.4				
35	2.7	3.0	3.2			
50	4.6	5.1	5.5	6.2		
60	6.1	6.7	7.2	8.2	9.4	
75	8.5	9.3	10.1	11.4	13.2	13.7
125	18.3	20.0	21.7	24.6	28.4	29.5
200	37.0	40.6	43.8	49.7	57.4	59.7
300	68.0	74.5	80.5	91.3	105.4	109.7
400	104.8	114.8	123.9	140.5	162.3	168.9
500	146.4	160.4	173.2	196.4	226.8	236.1
600	192.4	210.8	227.7	258.2	298.1	310.3

Note: Effective depth,  $h$  must be  $\geq 6 \times$  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, $\alpha^\circ$	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

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

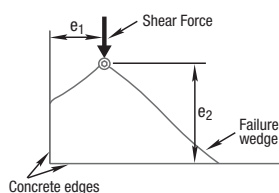
**Table 4e Multiple anchors effect, concrete edge shear,  $X_{vn}$**

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 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 4**

Design reduced ultimate concrete edge shear capacity,  $\phi V_{urc}$

$$\phi V_{urc} = \phi V_{uc} * X_{vc} * X_{vd} * X_{va} * X_{vn} * X_{vs}$$

**STEP 5**

**Verify anchor shear capacity - per anchor**

**Table 5a Reduced characteristic ultimate steel shear capacity,  $\phi V_{us}$  (kN),  $\phi_v = 0.8$**

Anchor size, $d_b$	M8	M10	M12	M16	M20	M24
ChemSet™ Anchor Stud Grade 5.8 Carbon Steel	8.9	14.1	21.0	39.7	59.9	86.8
ChemSet™ Anchor Stud A4/316 Stainless Steel	10.7	17.0	25.3	49.6	74.9	108.5
Typical Threaded Rod Grade 8.8 Carbon Steel	14.5	23.0	33.5	62.3	97.2	140.1

**Step 5b Reduced characteristic ultimate bolt steel shear capacity,  $\phi V_{sf}$  (kN)**

Not appropriate for this product.

**Checkpoint 5**

Design reduced ultimate shear capacity,  $\phi V_{ur}$   
 $\phi V_{ur} = \text{minimum of } \phi V_{urc}, \phi V_{us}$   
 Check  $V^* / \phi V_{ur} \leq 1$ ,  
 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	Stainless Steel Shear Capacity
Strength Limit State	$\phi V_{uc}$	MULTIPLY $\phi V_{uc}$ x 1.00	$\phi V_{us}$	MULTIPLY $\phi V_{us}$ x 1.00	MULTIPLY $\phi V_{us}$ x 1.00
Working Load Limit	$V_{ac}$	MULTIPLY $\phi V_{uc}$ x 0.55	$V_{as}$	MULTIPLY $\phi V_{us}$ x 0.50	MULTIPLY $\phi V_{us}$ x 0.52
Cyclic Loading	$V_{yc}$	Refer to page 40 for suitable anchor	$V_{ys}$	Refer to page 40 for suitable anchor	Refer to page 40 for suitable anchor
Fire Resistance	$V_{Rk,c,fi,t}$	Refer to pages 238-257	$V_{Rk,s,fi,t}$	Refer to pages 238-257	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	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	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  
 $N^*/\phi N_{ur} + V^*/\phi V_{ur} \leq 1.2$ ,  
 if not satisfied return to step 1

**Specify – Threaded Stud Anchors**

Ramset™ ChemSet™ Injection 101 PLUS  
 with (Anchor Size) grade 5.8  
 ChemSet™ Anchor Stud  
 ((Anchor Stud Part Number)).  
 Drilled hole depth to be (h) mm.

**Example**

Ramset™ ChemSet™ Injection 101 PLUS  
 with M16 grade 5.8  
 ChemSet™ Anchor Stud (CS16190).  
 Drilled hole depth to be 125 mm.  
 To be installed in accordance with  
 Ramset™ Technical Data Sheet.