13.1 GENERAL INFORMATION

PERFORMANCE RELATED	MATERIAL SPECIFICATION	INSTALLATION RELATED
	Zn GAL A4 316	

Product

ChemSet™ Maxima™ Spin Capsule is a heavy duty, acrylic capsule anchor.

Benefits, Advantages and Features

Certified Performance
- European Technical Approval 001 Part 5 Option 7.

No measuring, no mess, no waste:
- Adhesive is contained in pre-measured capsules.

Versatile:
- Use in damp or flooded holes or even underwater.

Fast installation:
- Cures in minutes and can be loaded in 20 min (at 20°C).

High bond strength:
- Acrylic adhesive.

High corrosion resistance:
(See table 4.5 pages 20 and 21.)

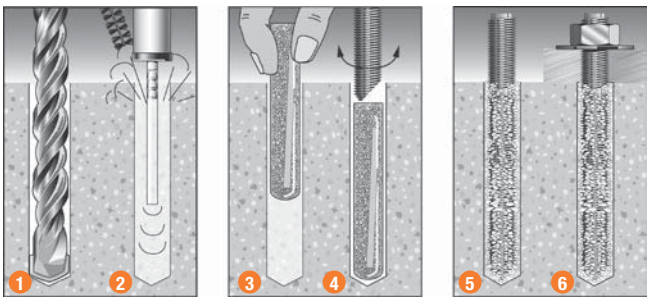
Rated for Sustained Loading

VOC Compliant

Principal Applications

- Structural steel
- Machine hold down
- Factory fit out
- Fencing
- Stadium seating
- Balustrades
- Signs
- Applications requiring a set number of fixings

Installation



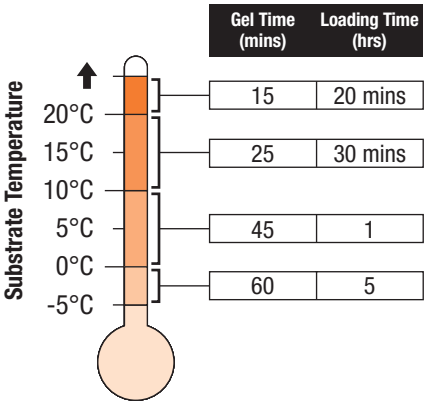
1. Drill recommended diameter and depth hole.
2. **Important:** Use **Ramset™** Dustless Drilling System to ensure holes are clean. Alternatively, clean dust and debris from hole with stiff wire or nylon brush and blower in the following sequence: blow x 4, brush x 3, blow x 4, brush x 3, blow x 4.
3. Insert correct size Spin capsule into the hole.
4. Using appropriate driver accessories, drive the ChemSet™ Anchor Stud into the hole using a hammer drill (on rotation).
5. Cure as per setting times.
6. Attach fixture and tighten nut in accordance with recommended tightening torque.

Installation temperature limits:
- Substrate: -5°C to 35°C.

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

Service temperature limits:
-40°C to 80°C.

Setting Times



Gel Time (mins)	Loading Time (hrs)
15	20 mins
25	30 mins
45	1
60	5

Installation and performance details: ChemSet™ Maxima™ Spin Capsules and ChemSet™ Anchor Stud

Anchor size, d_b (mm)	Drilled hole diameter, d_h (mm)	Fixture hole diameter, d_f (mm)	Anchor effective depth, h (mm)	Tightening torque, T_r (Nm)	Optimum dimensions*		
					Edge distance, e_c (mm)	Anchor spacing, a_c (mm)	Concrete substrate thickness, b_m (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.
**Note: To achieve these non standard effective depths, use an additional CHEM08 Maxima™ spin capsule per hole.

Anchor Size, d_b (mm)	Reduced Characteristic Capacity#						
	Grade 5.8 Steel Studs		AISI 316 Stainless Steel Studs		Concrete		
					Tension, $ØN_{uc}$ (KN)**		
					Concrete Compressive Strength, f'_c		
	Shear, $ØV_{us}$ (kN)	Tension, $ØN_{us}$ (kN)***	Shear, $ØV_{us}$ (kN)	Tension, $ØN_{us}$ (kN)***	20 MPa	32 MPa	40 MPa
M8	8.9	14.3	10.7	14.9	12.4	14.3	15.3
M10	14.1	22.7	17.0	23.8	16.7	19.2	20.5
M12	21.0	33.8	25.3	35.3	23.9	27.5	29.4
M16	39.7	64.7	49.6	69.3	35.0	40.2	43.0
M20	59.9	97.6	74.9	104.6	56.0	64.4	68.9
					63.4	72.9	78.0
M24	86.8	141.3	108.5	151.4	64.6	74.3	79.5
					84.9	97.6	104.4

* 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 = 0.6 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 carbon steel tensile capacity. **For conversion to Working Load Limit MULTIPLY $ØN_{us}$ x 0.45**
#Note: Design Tensile Capacity $ØN_{ur}$ = minimum of $ØN_{uc}$ and $ØN_{us}$

13.2 DESCRIPTION AND PART NUMBERS - ChemSet™ Maxima™ Spin Capsules

Capsule dimensions		To suit ChemSet™ Anchor Stud		Capsule Part No.
Nominal diameter, d (mm)	Capsule length, L (mm)	Anchor size, d_b	Effective depth, h (mm)	
9.5	80	M8	80	CHEM08
11	80	M10	90	CHEM10
13	95	M12	110	CHEM12
17	95	M16	125	CHEM16
21.5	115	M20	150	CHEM2024
21.5	115	M24	160	CHEM2024

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

13.3 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

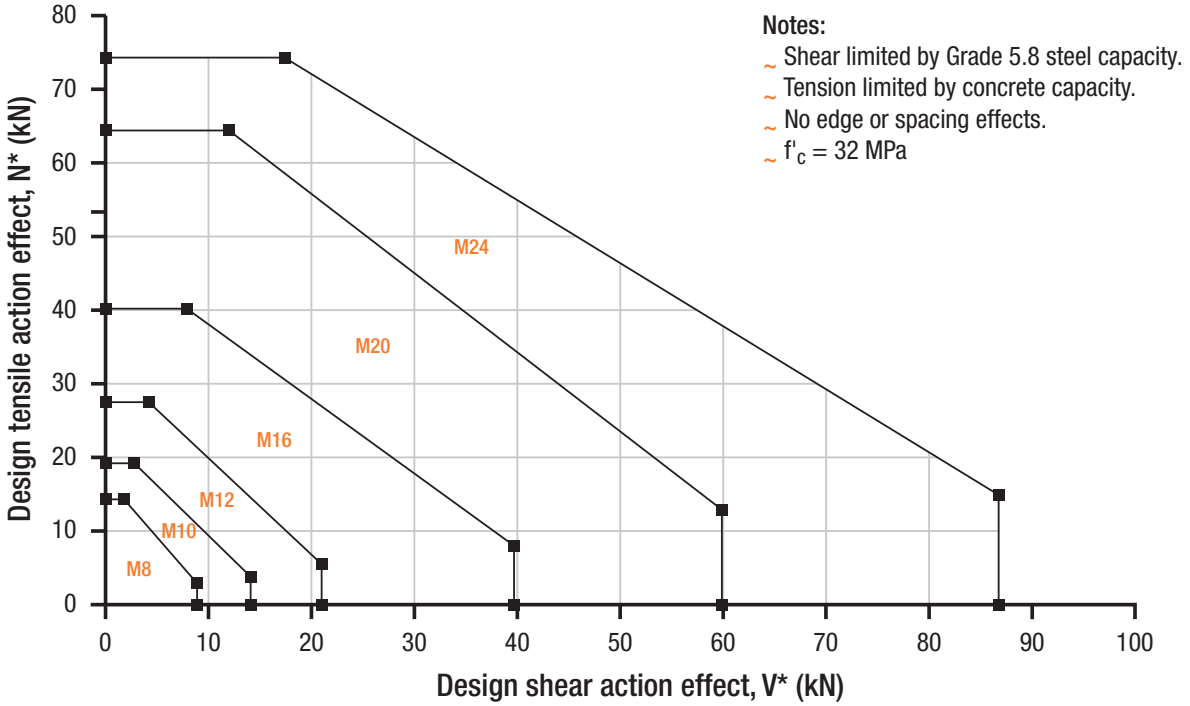


Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

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)

Anchor effective depth, h (mm) is read from the "Description and Part Numbers" table for ChemSet™ Maxima™ Spin Capsules on page 94.

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, $ØN_{uc}$ (kN), $Ø_c = 0.6$, $f'_c = 32$ MPa

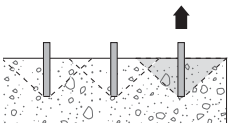
Anchor size, d_b	M8	M10	M12	M16	M20	M24
Drilled hole dia., d_h (mm)	10	12	14	18	24	26
Effective depth, h (mm)						
80	14.3					
90		19.2				
110			27.5			
125				40.2		
150					64.4	
160						74.3
170					72.9	
210						97.6

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 1**

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

f'_c (MPa)	20	25	32	40	50
X_{nc}	0.87	0.93	1.00	1.07	1.14

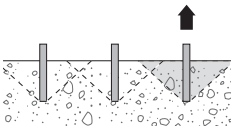
Table 2c Edge distance effect, tension, X_{ne}



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}

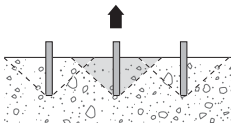
For single anchor design, $X_{nae} = 1.0$



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, $ØN_{urc}$

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

STEP 3 Verify anchor tensile capacity - per anchor

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

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

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

Not appropriate for this product.

Checkpoint 3

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

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

Check $N^* / ØN_{ur} \leq 1$,

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	$ØN_{urc}$	MULTIPLY $ØN_{urc}$ x 1.00	$ØN_{us}$	MULTIPLY $ØN_{us}$ x 1.00	MULTIPLY $ØN_{us}$ x 1.00
Working Load Limit	N_{ac}	MULTIPLY $ØN_{urc}$ x 0.55	N_{as}	MULTIPLY $ØN_{us}$ x 0.45	MULTIPLY $ØN_{us}$ x 0.50
Cyclic Loading	N_{yc}	MULITPLY $ØN_{urc}$ x 0.55	N_{ys}	MULITPLY $ØN_{us}$ x 0.45	MULITPLY $ØN_{us}$ x 0.50
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	$N^0_{Rd,p}$	Refer to pages 258-298	$N_{Rd,s}$	Refer to pages 258-298	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	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

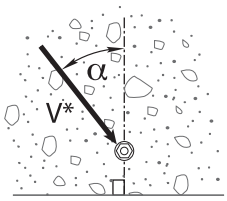
Table 4a Reduced characteristic ultimate concrete edge shear capacity, $ØV_{uc}$ (kN), $Ø_q$ = 0.6, f'_c = 32 MPa

Anchor size, d_b	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 ≥ 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

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

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

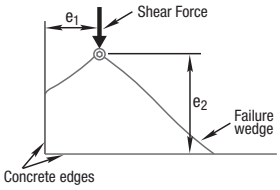
Edge distance, e (mm)	25	30	35	50	60	75	125	200	300	400	500	600
Anchor spacing, a (mm)												
25	0.70	0.67	0.64	0.60	0.58	0.57	0.54					
30	0.74	0.70	0.67	0.62	0.60	0.58	0.55	0.53				
35	0.78	0.73	0.70	0.64	0.62	0.59	0.56	0.54	0.52			
50	0.90	0.83	0.79	0.70	0.67	0.63	0.58	0.55	0.53	0.53		
60	0.98	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}



ANCHOR AT A CORNER

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 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

Checkpoint 4

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

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

STEP 5 Verify anchor shear capacity - per anchor

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

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

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

Not appropriate for this product.

Checkpoint 5

Design reduced ultimate shear capacity, $\emptyset V_{ur}$

$\emptyset V_{ur}$ = minimum of $\emptyset V_{urc}$, $\emptyset V_{us}$

Check $V^* / \emptyset V_{ur} \leq 1$,

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	$\emptyset V_{uc}$	MULTIPLY $\emptyset V_{uc}$ x 1.00	$\emptyset V_{us}$	MULTIPLY $\emptyset V_{us}$ x 1.00	MULTIPLY $\emptyset V_{us}$ x 1.00
Working Load Limit	V_{ac}	MULTIPLY $\emptyset V_{uc}$ x 0.55	V_{as}	MULTIPLY $\emptyset V_{us}$ x 0.50	MULTIPLY $\emptyset V_{us}$ x 0.52
Cyclic Loading	V_{yc}	MULITPLY $\emptyset V_{uc}$ x 0.55	V_{ys}	MULITPLY $\emptyset V_{us}$ x 0.50	MULITPLY $\emptyset V_{us}$ x 0.52
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

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

if not satisfied return to step 1

Specify – Spin Capsules

Ramset™ ChemSet™ Maxima™ Spin Capsule, ((Capsule Part Number)) with (Anchor Size) grade 5.8 ChemSet™ Anchor Stud ((Anchor Stud Part Number)).

Example

Ramset™ ChemSet™ Maxima™ Spin Capsule, (CHEM16) with M16 grade 5.8 ChemSet™ Anchor Stud (CS16190).

To be installed in accordance with Ramset™ Technical Data Sheet.