

ChemSet™ Maxima™

SPIN CAPSULES - NON-CRACKED CONCRETE

GENERAL INFORMATION

Performance Related	Material Specification	Installation Related

Product

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

Benefits, Advantages and Features

Design according to AS5216 (formerly TS101) and European design method EN1992-4 (formerly TR029)

Certified Performance

European Technical Assessment EAD 330499 - 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.

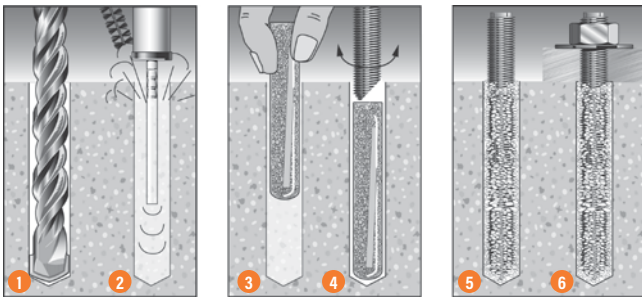
High corrosion resistance:

(See page 20 and 21.)

Rated for Sustained Loading

VOC Compliant

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.



Principal Applications

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

Recommended Installation Temperatures

	Minimum	Maximum
Substrate	0°C	35°C

Service Temperature Limits

-40°C to 80°C

Setting Times

Temperature of base material	Curing time in dry concrete	Curing time in wet concrete
≥ +0°C	5 h	10 h
≥ +5°C	1 h	2 h
≥ +20°C	20 min	40 min
≥ +30°C	10 min	20 min

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SPIN CAPSULES - NON-CRACKED CONCRETE

Installation and performance details: ChemSet™ Maxima™ 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 _r (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	40	165	330	140
M16	18	18	125	80	187	375	160
M20	22	22	170	120	255	510	220
M24	26	26	210	180	315	630	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 _b (mm)	Reduced Characteristic Capacity#								
	Grade 5.8 Steel Studs		Grade 8.8 Steel Studs		ANSI 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 _c		
						20 MPa	32 MPa	40 MPa	
M10	11.8	18.9	17.5	28.2	14.2	19.8	18.8	21.5	23.8
M12	17.5	28.1	26.0	41.9	21.1	29.5	27.6	31.5	34.8
M16	33.1	53.9	50.9	82.1	41.4	57.7	41.9	47.8	52.8
M20	49.9	81.3	76.8	123.9	62.4	87.1	67.6	77.1	85.2
M24	72.3	117.8	111.3	179.5	90.4	126.2	100.3	114.3	126.4

**Note: Reduced characteristic ultimate concrete tensile capacity = φN_{uc} where φ = 0.67 and N_{uc} = Characteristic ultimate concrete tensile capacity.

For conversion to Working Load Limit MULTIPLY φN_{uc} x 0.5

***Note: Reduced characteristic ultimate steel tensile capacity = φN_{us} where φ = 0.67 and N_{us} = Characteristic ultimate steel tensile capacity.

For conversion to Working Load Limit MULTIPLY φN_{us} x = 0.67 for Gr 5.8 & Gr 8.8

#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 +80°C

All data relevant for Non-Cracked Concrete - DO NOT USE IN FLOODED HOLES

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

DESCRIPTION AND PART NUMBERS

Capsule Dimensions (mm)		To suit ChemSet™ Anchor Stud		Capsule Part No.
Capsule Dimensions (mm)	Capsule length, L	Anchor Size, d _b	Effective depth, h (mm)	
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

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	52.8	450	650	62.3
M12	10.4	84.3	640	800	10	78.5	450	650	109.2
M16	14.1	157	640	800	14	153.9	450	650	277.5
M20	17.7	245	640	800	17.2	232.4	450	650	540.9
M24	21.2	353	640	800	20.7	336.5	450	650	935.5

Engineering Properties* for ChemSet™ Anchor Studs Grade 5.8 and AISI 316 Stainless Steel in the SARB ANZ on page 141.

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STRENGTH LIMIT STATE DESIGN

STEP 1 Select anchor to be evaluated

Table 1a Indicative combined loading - interaction diagram

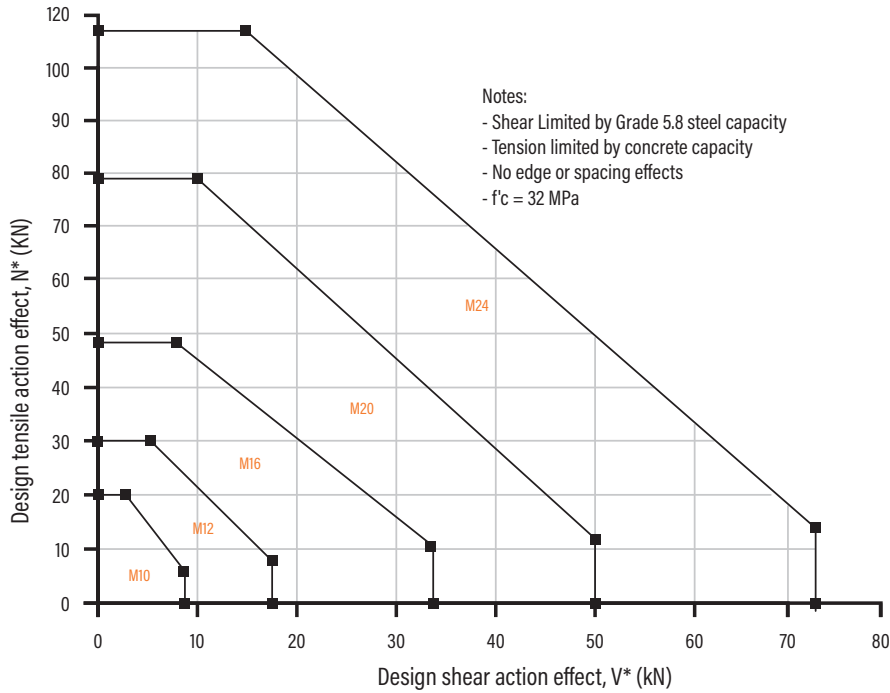


Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

Anchor size, d _s	M10	M12	M16	M20	M24
Min. Anchor Spacing - a _m	45	55	65	85	105
Min. Edge Distance - e _m	45	55	65	85	105

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.

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), $\phi_c = 1/1.5 = 0.67$, $f'_c = 32$ MPa

Anchor Size, d_b	Combined pull-out and concrete cone resistance - ϕN_{ucp}				
	M10	M12	M16	M20	M24
Drilled Hole Dia, d_h (mm)	12	14	18	22	26
Effective Depth, h (mm)					
90	21.5				
110		31.5			
125			47.8		
170				77.1	
210					114.3

For Sustained Loads MULTIPLY ϕN_{uc} x 0.6

All data relevant for Non-Cracked Concrete

DO NOT USE IN FLOODED HOLES

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

Table 2b-1 Concrete service temperature limits effect, tension, X_{ns}

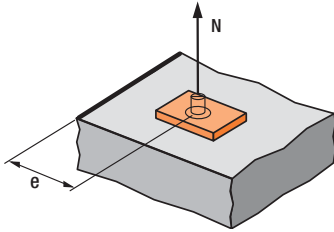
Service temperature (°C)	-40°C to +80°C
X_{ns}	1.00

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

f'_c (MPa)	20	25	32	40	50
X_{nc}	0.88	0.93	1.00	1.11	1.18

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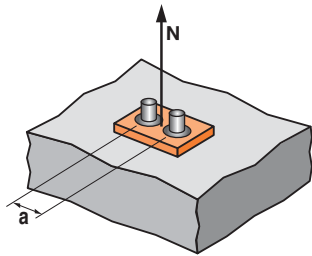
STRENGTH LIMIT STATE DESIGN



$X_{ne} = 0.25 + 0.5*(e/h)$
 Where $e_m \leq e \leq e_c$
 $e_c = 1.5*h$
 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
Edge distance, e (mm)					
45	0.50				
50	0.53				
55	0.56	0.50			
65	0.61	0.54	0.51		
85	0.72	0.63	0.59	0.50	
90	0.75	0.66	0.61	0.51	
105	0.83	0.72	0.67	0.55	0.50
120	0.92	0.80	0.73	0.60	0.54
135	1	0.86	0.79	0.65	0.57
165		1	0.91	0.74	0.64
187			1	0.80	0.70
255				1	0.86
315					1
420					



$X_{na} = 0.5 + a/(6*h)$
 Where $a_m \leq a \leq a_c$
 $a_c = 3*h$
 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
Anchor spacing, a (mm)					
45	0.58				
55	0.60	0.58			
65	0.62	0.59	0.58		
85	0.65	0.62	0.61	0.58	
105	0.69	0.65	0.64	0.60	0.58
130	0.74	0.70	0.67	0.63	0.60
140	0.76	0.71	0.69	0.64	0.61
150	0.78	0.73	0.70	0.65	0.62
200	0.87	0.80	0.77	0.70	0.66
270	1	0.91	0.86	0.76	0.71
330		1	0.94	0.82	0.76
375			1	0.87	0.80
510				1	0.90
630					1

Checkpoint 2

Design reduced ultimate concrete tensile capacity, ϕN_{urc}

$$\phi N_{urc} = \phi N_{uc} * X_{ns} * X_{nc} * X_{ne} * X_{na}$$

STEP 3

Verify anchor shear 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
ChemSet™ Anchor Stud Grade 5.8 Carbon Steel	18.9	28.1	53.9	81.3	117.8
ChemSet™ Anchor Stud A4/316 Stainless Steel	19.8	29.5	57.7	87.1	126.2
ChemSet™ Anchor Stud Grade 8.8 Carbon Steel	28.2	41.9	82.1	123.9	179.5

Note: $\phi_n = 0.58$ for ChemSet™ Anchor Stud A4/316 Stainless Steel

Checkpoint 3

Design reduced ultimate tensile capacity, ϕN_{ur}

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

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

if not satisfied return to step 1

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STEP 4

Step 4 - Verify concrete shear capacity - per anchor

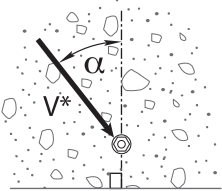
Table 4a Reduced characteristic ultimate concrete edge shear capacity, ϕV_{uc} (kN), $\phi = 1/1.5 = 0.67$, $f'_c = 32$ MPa

Anchor size, d_b	M10	M12	M16	M20	M24
Effective depth, h (mm)	90	110	125	170	210
Edge distance, e_m					
45	5.3				
55		7.4			
65			10.0		
85				15.6	
105					22.7

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

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

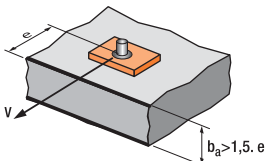
f'_c (MPa)	20	25	32	40	50
X_{vc}	0.79	0.86	1.0	1.11	1.22



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

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

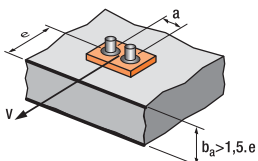


$$X_{ve} = e/e_m * \sqrt{e/e_m}$$

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

For single anchor fastening X_{ve}

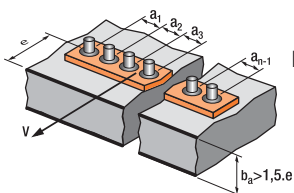
e/e_m	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
X_{ve}	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72



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

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



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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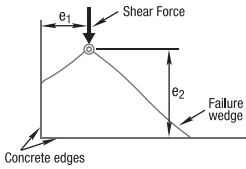
STRENGTH LIMIT STATE DESIGN

Table 4e Reduced characteristic ultimate concrete pryout capacity, ϕV_{ucp} (kN), $\phi = 1/1.5 = 0.67$, $f'_c = 32$ MPa

Anchor size, d_b	M10	M12	M16	M20	M24
Effective depth, h (mm)	90	110	125	170	210
-40 °C to +80 °C	43.0	63.0	95.5	154.2	228.6

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}

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

Checkpoint 4b

Design reduced ultimate concrete pryout capacity, ϕV_{urcp}

$$\phi V_{urcp} = \phi V_{ucp} * X_{nc} * X_{ne} * X_{na}$$

STEP 5 Verify anchor shear capacity - per anchor

Table 5a Reduced characteristic ultimate steel shear capacity, ϕV_{us} (kN) where $\phi_v = 0.67$

Anchor size, d_b	M10	M12	M16	M20	M24
ChemSet™ Anchor Stud Grade 5.8 Carbon Steel	11.8	17.5	33.1	49.9	72.3
ChemSet™ Anchor Stud A4/316 Stainless Steel	14.2	21.1	41.4	62.4	90.4
ChemSet™ Anchor Stud Grade 8.8 Carbon Steel	17.5	26.0	50.9	76.8	111.3

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

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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™ Maxima with (Anchor Size) grade
5.8 ChemSet™ Anchor Stud (Anchor Stud
Part Number) Drilled Hole Depth to be (h)
mm.

Example
Ramset™ Maxima Spin Capsule with
M16 grade 5.8 ChemSet™ Anchor Stud
(CS16190GH). Drilled hole depth to be
125mm. To be installed according to
Ramset™ Installation Instructions.