Introduction

CHEMICAL ANCHORING - THREADED INSERTS

Introduction

The Ramset™ post-installed Threaded Insert system features a CAD optimised multicone design for high performance in shallow embedment depths. The system features an integrated splined segment to prevent rotation when torque is applied and a sealed centering cap to protect the internal thread from dust and resin.

The New Generation Threaded Inserts are available in High Performance Grade 5.8 Carbon Steel or AISI 316 Stainless Steel and are designed to be installed with the Fast curing ChemSet™ 801 Xtrem™, Epcon™ C6 PLUS or Extra Heavy Duty ChemSet™ Reo 502™ Plus chemical injection systems. By utilising a chemical injection system, material and labour costs can be reduced as well as reducing installation error. The optimised shallow embedment reduces the chance of drilling into rebar and maximises installation options in thin slab applications.

Ramset™ Threaded Inserts finish flush with the surface of the substrate, leaving no protrusions when not in use, making them ideal for removable or temporary applications. The Threaded Insert accepts metric machine bolts or threaded rod maximising design opportunities.

In addition, the ability to select architectural grade bolt heads makes Ramset™ Threaded Inserts ideal for facade and balustrade systems where aesthetics may be a specific requirement.

The key advantage of Ramset™ chemical anchoring is that it does not impact an expansion stress on the surrounding substrate. This makes chemical anchoring ideal for close to edge fixings or for close anchor spacing.

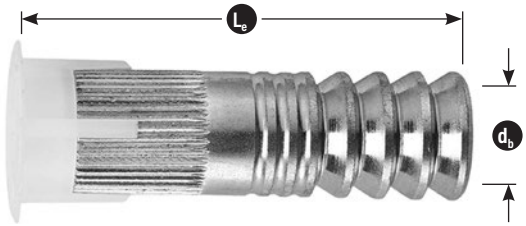
The ability of Ramset™ ChemSet™ Reo 502™ Plus, Epcon™ C6 PLUS and ChemSet™ 801 Xtrem™ XC² chemical anchoring to sustain cyclic tensile loads relies on adhesive bond, not on preload or tightening torque. The adhesive bond does not deteriorate or change over time making Ramset™ chemical anchors ideal for cyclic and vibrating load cases.

Threaded Inserts

CHEMICAL INJECTION - NON-CRACKED CONCRETE

GENERAL INFORMATION

Performance Related	Material Specification	Installation Related



Product

Threaded Inserts are internally threaded steel fixings and are installed using injection systems ChemSet™ Reo 502™ PLUS, Epcon™ C6 PLUS or ChemSet™ 801 Xtrem™ XC². Once installed, any threaded bolt is used to secure the fixture to concrete.

Benefits, Advantages and Features

Suitable for structural loads:

- High Performance Grade 5.8 Carbon Steel.
- High Performance AISI 316 Stainless Steel for Coastal or fresh water applications.

Greater security:

- High loads in shallow holes in thin slabs.

Versatile:

- Anchor in dry, damp, wet and flooded holes.
- Anchors in carbide drilled and diamond cored holes.
- Zinc Plated for indoor or dry climates.
- Supplied with plastic cap to protect threads during installation.

Fast installation:

- Chemical Injection System
- Protective cap
- Shallow embedment depths

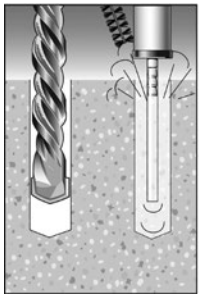
Ramset Design Method:

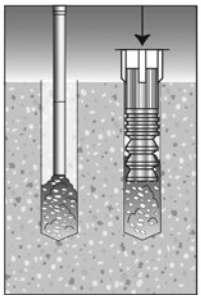
- Uses technical data validated from testing in ANZ concrete

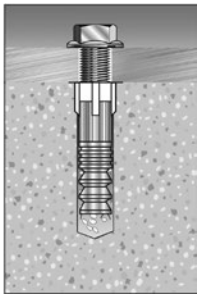
Principal Applications

- Machinery hold down
- Structural steel connections
- Seating
- Hand Rails
- Balustrade posts
- Removable fixings

Installation







1. Drill or core hole to specified diameter and depth
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 2, brush x 2, blow x 2, brush x 2, blow x 2.
3. Screw mixing nozzle onto cartridge and dispense 2-3 trigger pulls of adhesive to waste until colour is grey with no streaks
4. Insert tip of nozzle to bottom of hole and dispense adhesive
5. Fill hole to about 2/3 full
6. Insert threaded insert with rotating motion to release trapped air
7. Wait until adhesive has fully cured before loading (see Working Time / Loading Time chart for each adhesive)

Refer to Technical Data Sheet and MSDS available from www.ramset.com.au, for precautions and further detailed installation instructions

Setting Times

ChemSet™ Reo 502™ PLUS (AUS ONLY)
Installation temperature limits:
-Substrate: 5˚C to 40˚C
-Adhesive: 10˚C to 40˚C

Load should not be applied to anchor until the chemical has sufficiently cured as specified
Service temperature limits:
-40 ˚C to 70˚C

Temperature of base material	Cartridge Temperature	Gel Time	Curing time in dry and wet concrete
5°C	Minimum 10°C	300 min	24 h
10°C	10°C	150 min	18 h
15°C	15°C	40 min	12 h
20°C	20°C	25 min	8 h
25°C	25°C	18 min	6 h
30°C	30°C	12 min	4 h
40°C	40°C	6 min	2 h
Note: Cartridge temperature minimum +10°C			

Epcon™ C6 PLUS (NZ ONLY)
Installation temperature limits:
-Substrate: 5˚C to 40˚C
-Adhesive: 10˚C to 40˚C

Load should not be applied to anchor until the chemical has sufficiently cured as specified.
Service temperature limits:
-40 ˚C to 70˚C

Temperature of base material	Cartridge Temperature	Gel Time	Curing time in dry and wet concrete
5°C	Minimum 10°C	300 min	24 h
10°C	10°C	150 min	18 h
15°C	15°C	40 min	12 h
20°C	20°C	25 min	8 h
25°C	25°C	18 min	6 h
30°C	30°C	12 min	4 h
40°C	40°C	6 min	2 h
Note: Cartridge temperature minimum +10°C			

ChemSet™ 801 Xtrem™ XC²
Installation temperature limits:
-Substrate: 5˚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
Service temperature limits:
-40 ˚C to 80˚C

Temperature of base material	Gel Time	Curing time in dry concrete	Curing time in wet concrete
+5°C	60 min	240 min	480 min
6°C - 10°C	40 min	180 min	360 min
11°C - 20°C	15 min	120 min	240 min
21°C - 30°C	8 min	90 min	180 min
31°C - 40°C	4 min	60 min	120 min
Note: Cartridge temperature minimum +5°C			

Threaded Inserts

CHEMICAL INJECTION - NON-CRACKED CONCRETE

Installation and performance details:

Threaded Inserts with ChemSet™ Injection – Reo 502™ PLUS , Epcon™ C6 Plus and 801 Xtrem™ XC²

Anchor size, d_b (mm)	Installation details					Optimum dimensions		Concrete substrate thickness, b_m (mm)
	Drilled hole diam. , d_h (mm)	Fixture hole diameter, d_f (mm)	Anchor effective depth, h (mm)	Tightening torque, 5.8 A4 316 Bolt T_r (Nm)	Tightening torque, 8.8 grade Bolt T_r (Nm)	Anchor* spacing, a_c (mm)	Edge* distance, e_c (mm)	
M8	14	10	60	10	15	120	60	100
M10	20	12	65	22	30	130	65	100
M12	24	15	75	36	70	150	85	125
M16	28	20	125	80	120	250	125	180
M20	35	24	170	120	200	340	170	240

* For anchor spacings less than the optimum, please contact your local Ramset Engineer.

Anchor size, d_b (mm)	Reduced Characteristic Capacity#							
	Gr 5.8 Carbon Steel		Gr 316 Stainless Steel		Concrete			
	Threaded Insert Shear, ϕV_{us} (kN)	Threaded Insert Tension, ϕN_{us} (kN)***	Threaded Insert Shear, ϕV_{us} (kN)	Threaded Insert Tension, ϕN_{us} (kN)***	ChemSet™ Reo 502™ Plus & Epcon™ C6 Plus Tension, ϕN_{uc} (kN)**			ChemSet™ 801 Xtrem™ XC² Tension, ϕN_{uc} (kN)**
					Concrete compressive strength, f'_c			Concrete compressive strength, f'_c
					20 MPa	25 MPa	≥ 32 MPa	≥ 20 MPa
M8	7.4	14.4	9.1	18.5	11.1	11.5	12.2	11.1
M10	11.6	23.2	14.9	29.6	16.2	16.8	17.8	16.2
M12	16.9	33.6	21.6	43.2	19.7	20.4	21.6	19.7
M16	31.2	62.4	40.8	81.5	51.0	53.0	56.1	51.0
M20	48.8	97.4	-	-	100.1	104.1	110.1	100.1

* 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 = ϕN_{uc} where ϕ = 0.6 and N_{uc} = Characteristic ultimate concrete tensile capacity.
For conversion to Working Load Limit MULTIPLY ϕN_{uc} x 0.55
***Note: Reduced characteristic ultimate steel tensile capacity = ϕN_{us} where ϕ = 0.8 and N_{us} = Characteristic ultimate steel tensile capacity.
For conversion to Working Load Limit MULTIPLY ϕN_{us} x 0.57
#Note: Design Tensile Capacity ϕN_{ur} = minimum of ϕN_{uc} and ϕN_{us}
All data relevant for Non-Cracked Concrete.

DESCRIPTION AND PART NUMBERS

Anchor size, d_b (mm)	Drilled hole diam. , d_h (mm)	Overall Length, L (mm)	Effective Length, L_e (mm)	Thread Length, L_t (mm)	Part Number	
					Zinc 5.8 grade	Stainless Steel AISI 316
M8	14	60	60	25	062770	062860
M10	20	65	65	32	062480	062960
M12	24	75	75	38	062760	063100
M16	28	125	125	50	062800	051175
M20	35	170	170	63	062810	-

ENGINEERING PROPERTIES

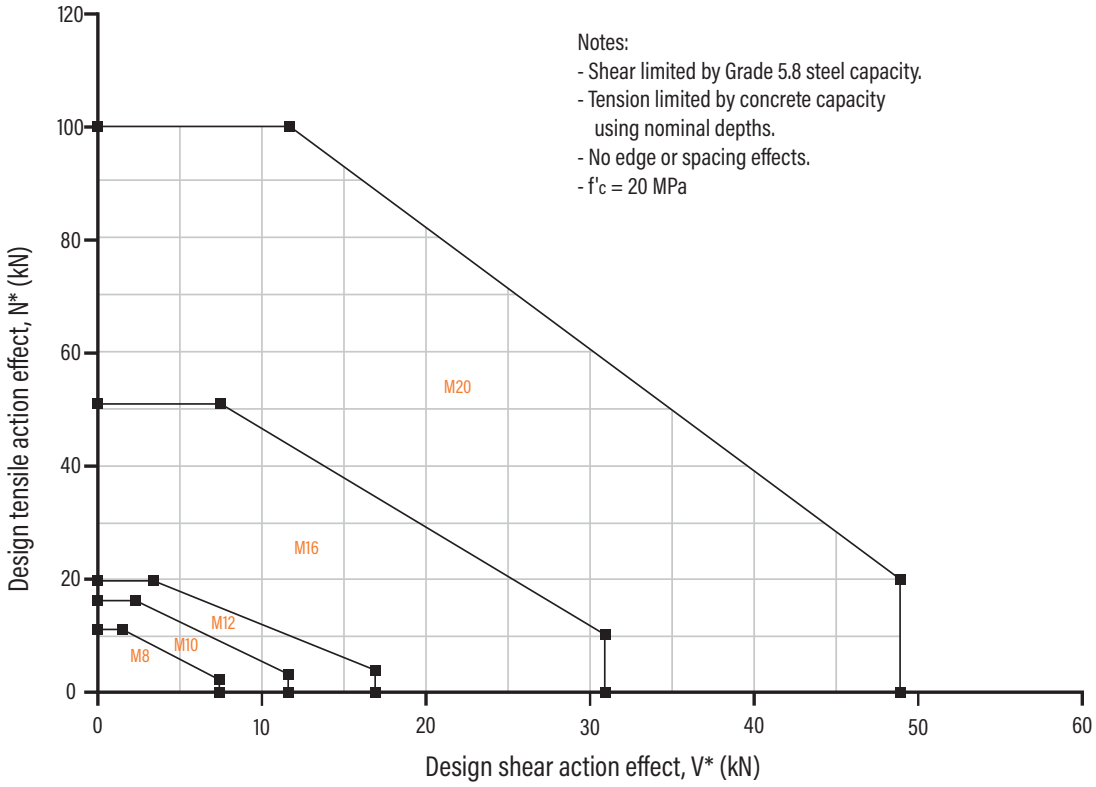
Anchor size, d_b	Carbon Steel		Stainless Steel	
	Yield Strength, f_{yk} (MPa)	Min. Tensile Strength, f_{uk} (MPa)	Yield Strength, f_{yk} (MPa)	Min. Tensile Strength, f_{uk} (MPa)
M8	420	520	350	650
M10	420	520	350	650
M12	420	520	350	650
M16	420	520	350	650
M20	420	520	-	-

Threaded Inserts

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_b	M8	M10	M12	M16	M20
Effective depth, h (mm)	60	65	75	125	170
e_m	40	45	55	65	85
a_m	40	45	55	65	85

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

Threaded Inserts

STRENGTH LIMIT STATE DESIGN

STEP 2

Verify concrete tensile capacity - per anchor

Table 2a Reduced characteristic ultimate concrete tensile capacity, ϕN_{uc} (KN), ϕ_c = 0.6, f'_c = 20 MPa

Anchor Size, d_b	M8	M10	M12	M16	M20
Drilled Hole Dia, d_h (mm)	14	20	24	28	35
Effective Depth, h (mm)					
60	11.1				
65		16.2			
75			19.7		
125				51.0	
170					100.1

NOTE: When Using ChemSet™ 801 Xtrem™ - WET HOLES: Multiply ϕN_{uc} * 0.6
When Using ChemSet™ Reo 502™ Plus and Epcon™ C6 Plus - WET HOLES: Multiply ϕN_{uc} * 0.7

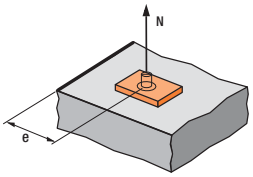
Table 2b-1 Concrete service temperature limits effect, tension, X_{ns}

Anchor size, d_b / Service temperature (˚C)	Epcon™ C6 PLUS	ChemSet™ Reo 502™ Plus	ChemSet™ 801 Xtrem™
-40˚C to +40˚C	1.00	1.00	1.00
-40˚C to +70˚C	1.00	1.00	0.90
-40˚C to +80˚C	N/A	N/A	0.90

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

f'_c	20	25	32	40	50
801 Xtrem™ XC² - X_{nc}	1	1	1	1	1
Reo 502 PLUS- X_{nc}	1	1.04	1.10	1.10	1.10
Epcon C6 PLUS - X_{nc}	1	1.04	1.10	1.10	1.10

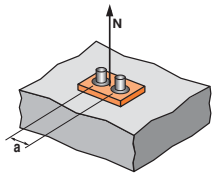
Table 2c - Edge distance effect, tension, X_{ne}



Anchor size, d_b / Edge distance, e (mm)	M8	M10	M12	M16	M20
40	0.75				
45	0.81	0.77			
55	0.93	0.88	0.80		
65	1	1	0.90	0.65	0.55
85			1	0.76	0.63
90				0.79	0.65
100				0.85	0.70
125				1	0.80
150					0.91
170					1

Table 2d - Anchor spacing effect, tension, X_{na}

For single anchor design, X_{na} = 1.0



Anchor size, d_b / Anchor spacing, a (mm)	M8	M10	M12	M16	M20
40	0.67				
45	0.69	0.67			
55	0.73	0.71	0.68		
65	0.77	0.75	0.72	0.63	
85	0.85	0.83	0.78	0.67	0.60
100	0.92	0.88	0.83	0.70	0.65
120	1	0.96	0.90	0.74	0.68
130		1	0.93	0.76	0.69
150			1	0.80	0.72
200				0.90	0.79
250				1	0.87
300					0.94
340					1

Checkpoint 2

Design reduced ultimate concrete tensile capacity, ϕN_{urc}

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

Threaded Inserts

STRENGTH LIMIT STATE DESIGN

STEP 3

Verify anchor tensile capacity - per anchor

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

Anchor size, d_b	M8	M10	M12	M16	M20
Threaded Insert Grade 5.8 Carbon Steel	14.4	23.2	33.6	62.4	97.4
Threaded Insert A4/316 Stainless Steel	18.5	29.6	43.2	81.5	-

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

Establish the reduced characteristic ultimate bolt steel tensile capacity, ϕN_{tf} from literature supplied by the specified bolt manufacturer. For nominal expected capacities of bolts manufactured to ISO standards, refer to Pg 322

Checkpoint 3

Design reduced ultimate tensile capacity, ϕN_{ur}

ϕN_{ur} = minimum of ϕN_{urc}, ϕN_{us}, ϕN_{tf}

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

if not satisfied return to step 1

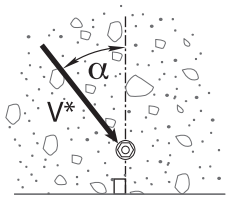
STEP 4

Verify concrete shear capacity - per anchor

Table 4a - Reduced characteristic ultimate concrete edge shear capacity, ϕV_{uc} (kN) $\phi_q = 0.6$, $f'_c = 20$ MPa

Anchor size, d_b	M8	M10	M12	M16	M20
Effective depth, h (mm)	60	65	75	125	170
Edge distance, e_m					
40	2.3				
45		3.1			
55			4.5		
65				6.6	
85					11.3

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



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

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

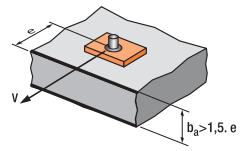
f'_c (MPa)	20	25	32	40	50
X_{vc}	1	1	1.17	1.26	1.34

Table 4c - 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

Threaded Inserts

STRENGTH LIMIT STATE DESIGN

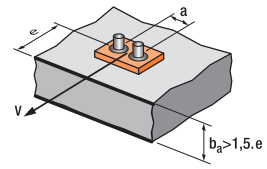


$X_{ve} = e/e_m * \sqrt{e/e_m}$

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

For single anchor fastening X_{ve}

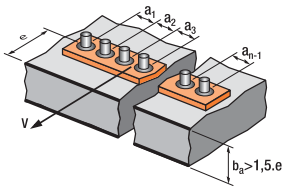
e/e_m	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
X_{ve}	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72



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

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	4.65

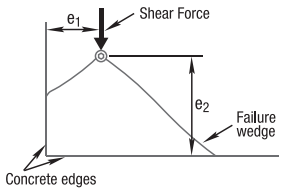


For 3 anchors fastening and more X_{ve}

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

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

Checkpoint 4

Design reduced ultimate concrete edge shear capacity, ϕV_{urc}

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

Threaded Inserts

STRENGTH LIMIT STATE DESIGN

STEP 5 Verify anchor shear capacity - per anchor

Table 5a - Reduced characteristic ultimate steel shear capacity, ϕV_{us} (kN), $\phi_V = 0.8$

Anchor size, d_b	M8	M10	M12	M16	M20
Threaded Insert Grade 5.8 Carbon Steel	7.4	11.6	16.9	31.2	48.8
Threaded Insert A4/316 Stainless Steel	9.1	14.9	21.6	40.8	-

Step 5b - Reduced characteristic ultimate bolt steel shear capacity ϕV_{sf} (kN)

Establish the reduced characteristic ultimate bolt steel shear capacity, ϕV_{sf} from litrerature by the specified bolt manufacturer. For nominal expected capacities of bolts manufactured to ISO Standards, refer to page 322.

Checkpoint 5

Design reduced ultimate shear capacity, ϕV_{ur}

ϕV_{ur} = minimum of ϕV_{urc}, ϕV_{us}, ϕV_{sf}

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

if not satisfied return to step 1

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

Ramset™ Threaded Insert Chemical Injection
Threaded Insert (Size) (Part number)
Injection System (Type) (Part number)
Maximum fixed thickness to be (t) mm.

Example

Ramset™ Threaded Insert Chemical Injection
Threaded Insert M12 (062760)
ChemSet™ Reo 502™ Plus (REO502P600)
Maximum fixed thickness to be 8 mm.
To be installed in accordance with Ramset™ Installation Instructions.