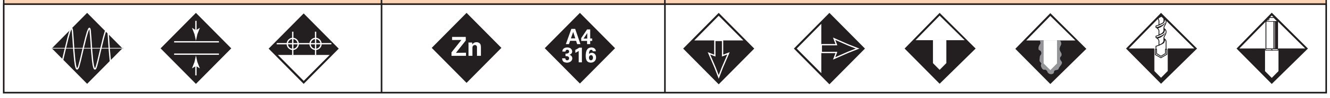
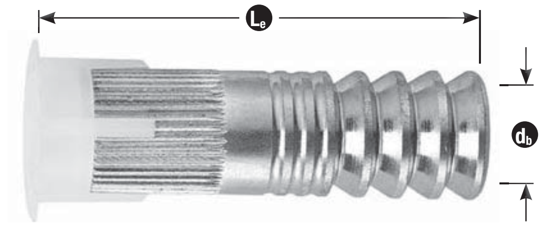
14.1 GENERAL INFORMATION

PERFORMANCE RELATED	MATERIAL SPECIFICATION	INSTALLATION RELATED



Product

Threaded Inserts are internally threaded steel fixings and are installed using injection systems ChemSet™ Reo 502™, Epcon™ C6 or Structaset™ 401. 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.

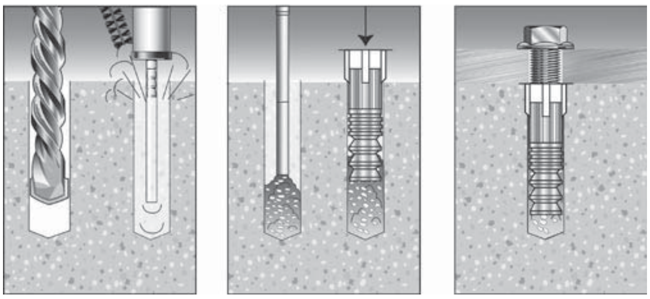
Versatile:
- Anchor in dry, damp, wet and flooded holes.
- Anchors in carbide drilled and diamond cored holes.
- Zinc Plated for indoor or dry climates.
- Supplied with plastic cap to protect threads during installation.

Fast installation:
- Chemical Injection System
- Protective cap
- Shallow embedment depths

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 4, brush x 3, blow x 4, brush x 3, blow x 4.
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

ChemSet™ Reo 502™ (AUS ONLY) Installation temperature limits:

-Substrate: 5˚C to 40˚C
-Adhesive: 20˚C to 32˚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

Substrate Temperature	Reo 502™ Working Time (mins)	Reo 502™ Cure Time (hrs)	Reo 502™EF Working Time (mins)	Reo 502™EF Cure Time (hrs)
40°C				
30°C	8.5	2	8.5	6
25°C	12	2.5		
20°C	20	3	13	12
15°C	23	5	17	22
10°C	27	8	22	48
5°C			32	96
0°C				

Note: Cartridge temperature minimum 20°C.

Note: Cure time extended in flooded conditions. Refer Tech Data Sheet.

Epcon™ C6 (NZ ONLY) Installation temperature limits:

- Substrate: 5°C to 40°C.
- Mortar: 18°C to 35°C.

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

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.

Structaset™ 401 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

Service temperature limits:
-40 ˚C to 80˚C

Setting Times

Substrate Temperature	401 Gel Time (mins)	401 Loading Time (mins)
40°C	–	–
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:
Threaded Inserts with ChemSet™ Injection – Reo 502™, Epcon™ C6 and Structaset™ 401

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, ØV_{us} (kN)	Threaded Insert Tension, ØN_{us} (kN)***	Threaded Insert Shear, ØV_{us} (kN)	Threaded Insert Tension, ØN_{us} (kN)***	ChemSet™ Reo 502™ & Epcon™ C6 Tension, ØN_{uc} (kN)** Concrete compressive strength, f'_c			Structaset™ 401 - Tension, ØN_{uc} (kN)** 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 = 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 steel tensile capacity.
For conversion to Working Load Limit MULTIPLY ØN_{us} x 0.57
#Note: Design Tensile Capacity ØN_{ur} = minimum of ØN_{uc} and ØN_{us}

14.2 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	-

14.3 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	-	-
M20	420	520	-	-

STEP 1 Select Anchor to be evaluated

Table 1a Indicative combined loading - interaction diagram

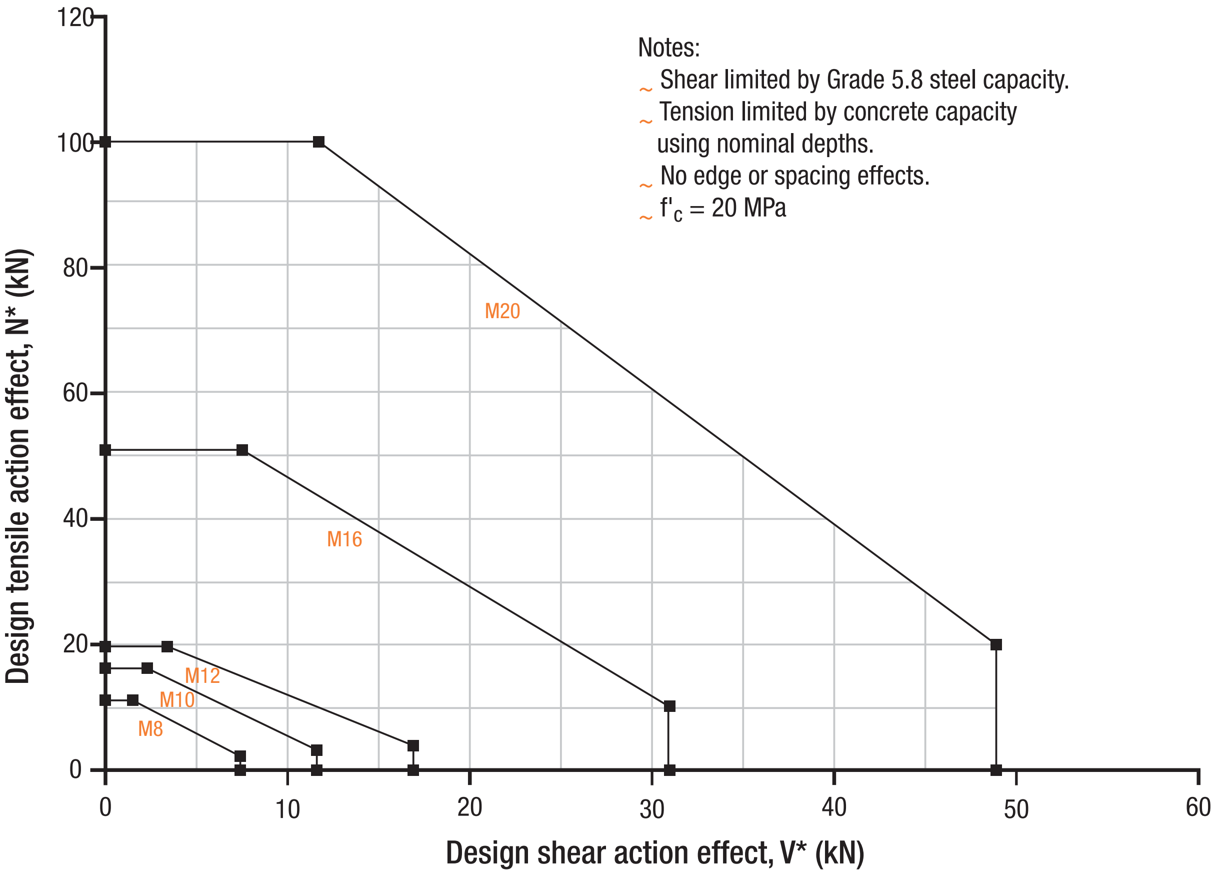


Table 1b Absolute minimum edge distance and anchor spacing values, e_m and a_m (mm)

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.

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 = 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 Structaset™ 401 - WET HOLES: Multiply $ØN_{uc}$ * 0.6
When Using ChemSet™ Reo 502™ and Epcon™ C6 - **WET HOLES: Multiply $ØN_{uc}$ * 0.7**

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

Service Temp °C	<45	50	55	60	65	70	>70
401 & Reo 502 - X_{ns}	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Epcon C6 - 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	20	25	32	40	50
401 - X_{nc}	1	1	1	1	1
Reo 502 - X_{nc}	1	1.04	1.10	1.10	1.10
Epcon C6 - X_{nc}	1	1.04	1.10	1.10	1.10

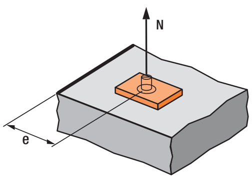


Table 2c - Edge distance effect, tension, X_{ne}

Anchor size, d_b	M8	M10	M12	M16	M20
Edge distance, e (mm)					
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

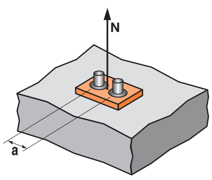


Table 2d - Anchor spacing effect, tension, X_{na}
For single anchor design, X_{na} = 1.0

Anchor size, d_b	M8	M10	M12	M16	M20
Anchor spacing, a (mm)					
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}

$$ØN_{urc} = ØN_{uc} * X_{ns} * X_{nc} * X_{ne} * X_{na}$$

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
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, $ØN_{tf}$ (kN)

Establish the reduced characteristic ultimate bolt steel tensile capacity, $ØN_{tf}$ from literature supplied by the specified bolt manufacturer. For nominal expected capacities of bolts manufactured to ISO standards, refer to page 236.

Checkpoint 3

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

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

Check $N^*/ ØN_{ur} \leq 1$,

if not satisfied return to step 1

Tensile performance conversion table

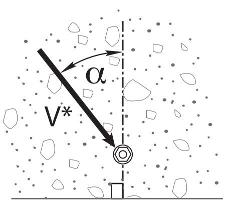
Performance Required	Concrete Tensile Performance		Steel Tensile Performance		
	Notation	Concrete Tension Capacity	Notation	Carbon Steel Tension Capacity	Stainless Steel Tension Capacity
Strength Limit State	$ØN_{urc}$	MULTIPLY $ØN_{urc}$ x 1.00	$ØN_{us}$	MULTIPLY $ØN_{us}$ x 1.00	MULTIPLY $ØN_{us}$ x 1.00
Working Load Limit	N_{ac}	MULTIPLY $ØN_{urc}$ x 0.55	N_{as}	MULTIPLY $ØN_{us}$ x 0.57	MULTIPLY $ØN_{us}$ x 0.57
Cyclic Loading*	N_{yc}	MULITPLY $ØN_{urc}$ x 0.55	N_{ys}	MULITPLY $ØN_{us}$ x 0.57	MULITPLY $ØN_{us}$ x 0.57
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
*Not applicable for StructaSet™ 401

STEP 4 Verify concrete shear capacity - per anchor

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

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



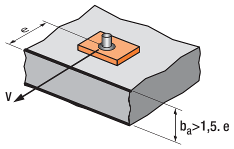
Load direction effect, conc. edge shear, X_{vd}

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

f'_c (MPa)	20	25	30	40	50
X_{vc}	1	1	1.14	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

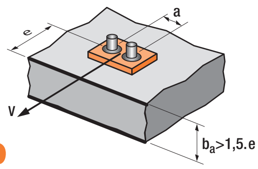


$X_{ve} = e/e_m * \sqrt{e/e_m}$

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

For single anchor fastening X_{ve}

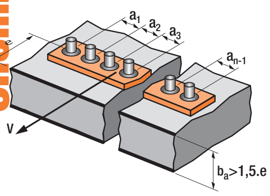
e/e_m	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
X_{ve}	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72



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

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

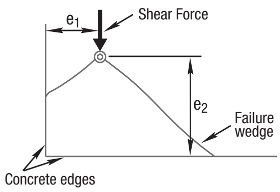


For 3 anchors fastening and more X_{ve}

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

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}

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

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, ØVsf from litrerature by the specified bolt manufacturer. For nominal expected capacities of bolts manufactured to ISO Standards, refer to page 236.

Checkpoint 5

Design reduced ultimate shear capacity, $ØV_{ur}$
$ØV_{ur}$ = minimum of $ØV_{urc}$, $ØV_{us}$, $ØV_{sf}$
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	Stainless Steel Shear Capacity
Strength Limit State	$ØV_{uc}$	MULTIPLY $ØV_{uc}$ x 1.00	$ØV_{us}$	MULTIPLY $ØV_{us}$ x 1.00	MULTIPLY $ØV_{us}$ x 1.00
Working Load Limit	V_{ac}	MULTIPLY $ØV_{uc}$ x 0.55	V_{as}	MULTIPLY $ØV_{us}$ x 0.50	MULTIPLY $ØV_{us}$ x 0.50
Cyclic Loading*	V_{yc}	MULITPLY $ØV_{uc}$ x 0.55	V_{ys}	MULITPLY $ØV_{us}$ x 0.50	MULITPLY $ØV_{us}$ x 0.50
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
*Not applicable for StructaSet™ 401

STEP 6 Combined loading

Checkpoint 6

Check $N^*/ØN_{ur} + V^*/ØV_{ur} \leq 1.2$,
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™ (REO502J)
Maximum fixed thickness to be 8 mm.
To be installed in accordance with Ramset™ Technical Data Sheet.