Ramset™

Chemset™ C8 Extreme

CHEMICAL ANCHORING

Deformed Reinforcing Bar

Version 5 | 2012

Ramset™
www.ramset.co.nz

Legend of Symbols

Performance related symbols

Independent European Organisation for Technical Approvals performance appraisals.


Suitable for use in the Tension Zones of concrete structures.


Has good resistance to cyclic, and pulse loading. Resists loosening under vibration.


Anchor has a fully functioning pull-down feature, or is a stud anchor. It has the ability to clamp the fixture to the base material and provide high resistance to cyclic loading.


Has good resistance to shock loading.


Suitable for elevated temperate applications. Structural anchor components made from steel. Any plastic or non-ferrous parts make no contribution to holding power under elevated temperatures.


May be used close to edges (or another anchor) without risk of splitting the concrete.


Tested for creep under long term loads.


Concrete tensile capacity.


Anchor tensile capacity.


Concrete shear capacity.


Anchor shear capacity.

Material specification symbols

Minimum plating thickness 6 µm.

Minimum plating thickness 42 µm.

Stainless steel, resistant to corrosive agents including chlorides and industrial pollutants.

Installation related symbols


Suitable for contact with drinking water for human consumption.


Suitable for floor applications.


Suitable for wall applications.


Suitable for overhead applications.


Suitable for hollow brick/block and hollow core concrete applications.


Anchor is cast into substrate by either puddling, attaching to reinforcing or formwork.


Anchor can be through fixed into substrate using fixture as template.


Suitable for use in dry holes.


Suitable for use in damp holes.


Suitable for use in holes filled with water.


Suitable for use in drilled holes.


Suitable for use in cored holes.


Temporary or removable fixing.

Notation

a = actual anchor spacing (mm)

a_c = critical anchor spacing (mm)

a_m = absolute minimum anchor spacing (mm)

A_s = stress area (mm^2)

b_m = minimum substrate thickness (mm)

d_b = bolt diameter (mm)

d_f = fixture hole diameter (mm)

d_h = drilled hole diameter (mm)

e = actual edge distance (mm)

e_c = critical edge distance (mm)

e_m = absolute minimum edge distance (mm)

f'_c = concrete cylinder compressive strength (MPa)

f_u = characteristic ultimate steel tensile strength (MPa)

f_y = characteristic steel yield strength (MPa)

h = anchor effective depth (mm)

h_d = drilled hole depth (mm)

L = anchor length (mm)

L_e = anchor effective length (mm)

Lsy.t = reinforcing bar length to develop full yeild in tension (mm)

Lyst.t_{nom} = length of reinforcing bar to develop full yeild in 32MPa concrete (mm)

M^* = design bending action effect (Nmm)

N^* = design tensile action effect (kN)

N_u = ultimate tensile capacity (kN)

N_{uc} = characteristic ultimate concrete tensile capacity (kN)

N_{ur} = design ultimate concrete capacity (kN)

N_{urc} = design ultimate concrete tensile capacity (kN)

N_{us} = characteristic ultimate steel tensile capacity (kN)

t = total thickness of fastened material(s) (mm)

V^* = design shear action effect (kN)

V_u = ultimate shear capacity (kN)

V_{uc} = characteristic ultimate concrete edge shear capacity (kN)

V_{ur} = design ultimate shear capacity (kN)

V_{urc} = design ultimate concrete edge shear capacity (kN)

V_{us} = characteristic ultimate steel shear capacity (kN)

V_{usc} = characteristic ultimate combined concrete/steel sheer capacity (kN)

X_{nae} = anchor spacing effect, end of a row, tension

X_{nai} = anchor spacing effect, internal to a row, tension

X_{nc} = concrete compressive strength effect, tension

X_{nk} = installation in tension zone effect, tension

X_{nt} = anchor service temperature effect, tension

X_{ne} = edge distance effect, tension

X_{nw} = effect of water filled holes, tension

X_{va} = anchor spacing effect, concrete edge shear

X_{vc} = concrete compressive strength effect, shear

X_{vd} = load direction effect, concrete edge shear

X_{vk} = installation in tension zone effect, shear

X_{vn} = multiple anchors effect, concrete edge shear

X_{vsc} = concrete compressive strength effect, combined concrete/steel shear

Z = section modulus (mm^3)

ß = concrete cube compressive strength (N/mm^2)

$Ø_c$ = capacity reduction factor, concrete tension recommended as 0.6

$Ø_m$ = capacity reduction factor, steel bending recommended as 0.8

$Ø_n$ = capacity reduction factor, steel tension recommended as 0.8

$Ø_q$ = capacity reduction factor, concrete edge shear recommended as 0.6

$Ø_v$ = capacity reduction factor, steel shear recommended as 0.8

Deformed Bar Worksheet

Step 1
Choose appropriate chemical anchor type

Epcon C6	Chemset A7 Ultra	Chemset C8 Extreme / REO502	

Step 2
Choose appropriate design case

Design Case	1	2	3	4

Design Case = ☐

Step 3
Select deformed bar size (mm)

10mm	12mm	16mm	20mm	25mm	32mm	40mm

☐

$L_{sy.t}$ < Concrete depth available

Step 4
Effective Length, $L_{sy.t\ (nom)}$ from selected design case

$L_{sy.t\ (nom)}$ = ☐ (mm)

Step 5
Water in hole effect, tension X_{nw}

Hole Condition	Dry	Damp	Wet
X_{nw}	1.00	1.00	1.43

X_{nw} = ☐

Step 6
Concrete compressive strength effect on development length, tension X_{nc}

f_c (MPa)	20	25	32	40	50
X_{nc}	1.26	1.13	1	0.89	0.8

X_{nc} = ☐

Step 7
Calculate $L_{sy.t} = L_{sy.t(nom)} * X_{nw} * X_{nc}$

$L_{sy.t}$ = ☐ (mm)

Step 8
Concrete depth available (mm)

= ☐ (mm)

Step 9
If $L_{sy.t}$ < Concrete depth available
then calculation is complete

$L_{sy.t}$ < Concrete depth (tick) ☐

$L_{sy.t}$ > Concrete depth available

Step 10
Design tensile steel stress $\sigma_{st(nom)}$ at concrete depth available (MPa)

☒ σ_{st}(nom) ☐ (MPa)

Step 11
Water in hole effect, tension X_{nw}

Hole Condition	Dry	Damp	Wet
X_{nw}	1.00	1.00	1.43

X_{nw} = ☐

Step 12
Concrete compressive strength effect on development length, tension X_{nc}

f_c (MPa)	20	25	32	40	50
X_{nc}	1.26	1.13	1	0.89	0.8

X_{nc} = ☐

Step 13
Calculate $\sigma_{st} = \sigma_{st(nom)} / (X_{nw} * X_{nc})$

σ_{st} = ☐ (MPa)

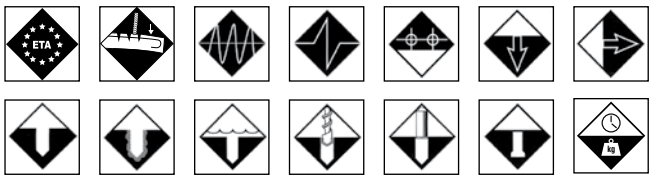
Typical Engineering Properties of Grade 500 Reinforcing Bar

Rebar Size (mm)	10	12	16	20	25	32	40
Stress Area, A_s (mm^2)	78.5	113	201	314	491	804	1260
Yeild Stress, f_{ay} (MPa)	500	500	500	500	500	500	500
Tensile Steel Yeild Capacity N_{sy}, (kN)	39.3	56.5	100.5	157.0	245.5	402.0	630.0

For further information refer to reinforcing bar manufacturer's published information and AS/NZS 4671:2001

Chemset™ C8 Extreme / REO 502

General Information



Product

Chemset™ C8 Extreme is a long working time, fast cure, heavy duty, epoxy injection anchor.

Independent Appraisals

European Technical Approval
ETA 10/0309* ETAG 001-5
TR029 Option 1

European Technical Approval
ETA 07/0189* ETAG 001-5
TR023

*Available from Ramset

Features

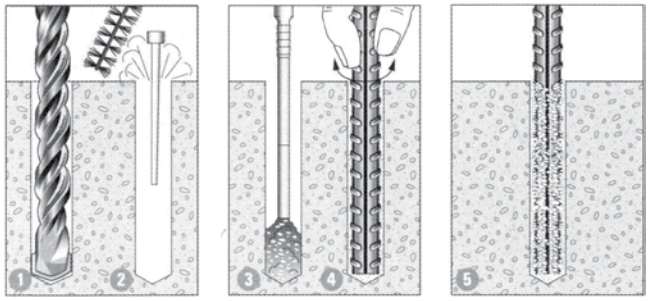
Greater productivity
- Shorter 500 MPa bar development lengths from high bond strength - faster installation.
- Anchors in dry, damp, wet or flooded holes - no weather delays.
- Fast cure time.
- Easy dispensing

Greater security
- 500 MPa bar development lengths certified to AS/NZS4671 -2001.
- Specially formulated Grade 500 reinforcing bars.
- Long 15 minute working time to allow full bar insertion.

Versatile
- Anchors in dry, damp, wet and flooded holes.
- Anchors in carbide drilled and diamond core holes.
- For tropical and temperate climates.

Greater safety
- Low odour.
- Non-flammable.

Installation



1. Drill recommended diameter and depth hole.
2. Clean hole with hole cleaning brush. Remove all debris using hole blower.
3. Insert mixing nozzle to bottom of hole. Fill hole to ¾ the hole depth slowly, ensuring no air pockets form.
4. Insert Grade 500 reinforcing bar to bottom of hole while turning.
5. Allow Chemset™ C8 Extreme to cure as per setting times.

Installation temperature limits:
Substrate: 5°C to 40°C.
Mortar: 5°C to 35°C.

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

Approximate Setting Times

Substate Temperature	Chemset C8 Extreme Gel Time (mins)	Chemset C8 Extreme Loading Time (hrs)
40°C	5	6
30°C	5	8
25°C	8	12
20°C	11	16
10°C	14	23
5°C	20	30

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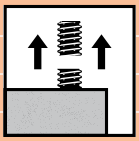
Design Case 1 For Single Bar Remote from an Edge ($e \geq 4\ d_b$)

Concrete Splitting Factors

k_1	1.0
k_2	1.0

Table 1 Stress in Steel, σ_{st} at selected effective length, L_{st}

Rebar Size	10	12	16	20	25	32	40
Drilled Hole Dia, d_h (mm)	14	16	20	25	30	40	50
Minimum Cover, e (mm)	40	48	64	80	100	128	160
Minimum Clear Spacing, a (mm)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Reduced Ultimate Tensile Adhesive Bond Capacity, ΦN_{ub}, (kN), Φ_c = 0.6	39.3	56.5	100.5	157.0	245.5	402.0	630.0
Nominal development length of bar in tension, Lsy.t (nom) (mm)	105	140	205	265	365	470	615
Effective Length, L_{st} (mm)	Stress Developed in Steel, $\sigma_{st(nom)}$ (MPa)						
40	190						
50	238						
60	286						
70	333	250					
80	381	286					
95	452	339					
105	**500**	375	256				
115	548	411	280				
130	619	464	317				
140	667	**500**	341	264			
160	762	571	390	302			
185	881	661	451	349			
205		732	**500**	387	281		
225		804	549	425	308		
245		875	598	462	336		
265			646	**500**	363	282	
300			732	566	411	319	
335			817	632	459	356	
365				689	**500**	388	297
400				755	548	426	325
435				821	596	463	354
470					644	**500**	382
520					712	553	423
570					781	606	463
615						654	**500**
660						702	537
705						750	573
750							610
795							646
840							683



500 = denotes tensile steel yield stress. Interpolations permitted. Do not extrapolate. *Spacing not relevant for single bar.

See deformed bar worksheet, Page 104 for calculating process.

Chemset™ C8 Extreme / REO 502

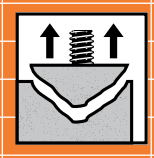
Design Case 2 Multiple Bars in Walls and Slabs, Clear Spacing > 150mm (AS3600 - 2001, clause 13.1.2.1)

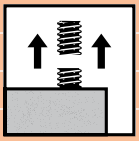
Concrete Splitting Factors

k_1	1.0
k_2	1.7

Table 2 Stress in Steel, σ_{st} at selected effective length, L_{st}

Rebar Size	10	12	16	20	25	32	40
Drilled Hole Dia, d_h (mm)	14	16	20	25	30	40	50
Minimum Cover, e (mm)	30	30	32	40	50	64	80
Minimum Clear Spacing, a (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Reduced Ultimate Tensile Adhesive Bond Capacity, ΦN_{ub}, (kN), Φ_c = 0.6	39.3	56.5	100.5	157.0	245.5	402.0	630.0
Nominal development length of bar in tension, Lsy.t (nom) (mm)	180	240	350	450	620	800	1,045
Effective Length, L_{st} (mm)	Stress Developed in Steel, $\sigma_{st(nom)}$ (MPa)						
60	167						
80	222						
100	278						
120	333	250					
140	389	292					
160	444	333					
180	**500**	375	257				
200	556	417	286				
220	611	458	314				
240	667	**500**	343	267			
275	764	573	393	306			
315	875	656	450	350			
350		729	**500**	389	282		
385		802	550	428	310		
420		875	600	467	339		
450			643	**500**	363	281	
505			721	561	407	316	
565			807	628	456	353	
620				689	**500**	388	297
680				756	548	425	325
740				822	597	463	354
800					645	**500**	383
880					710	550	421
965					778	603	462
1045						653	**500**
1125						703	538
1205						753	577
1285							615
1365							653
1445							691





500 = denotes tensile steel yield stress. Interpolations permitted. Do not extrapolate.

See deformed bar worksheet, Page 104 for calculating process.

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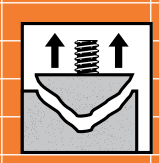
Design Case 3 Longitudinal Bars in Beams and Columns with Fitments (AS3600 - 2001, clause 13.1.2.1)

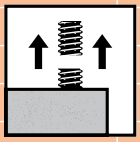
Concrete Splitting Factors

k_1	1.0
k_2	2.2

Table 3 Stress in Steel, σ_{st} at selected effective length, L_{st}

Rebar Size	10	12	16	20	25	32	40
Drilled Hole Dia, d_h (mm)	14	16	20	25	30	40	50
Minimum Cover, e (mm)	30	30	32	40	50	64	80
Minimum Clear Spacing, a (mm)	40	48	64	80	100	128	160
Reduced Ultimate Tensile Adhesive Bond Capacity ΦN_{ub}, (kN), Φ_c = 0.6	39.3	56.5	100.5	157.0	245.5	402.0	630.0
Nominal development length of bar in tension, Lsy.t (nom) (mm)	230	310	450	585	805	1,035	1,355
Effective Length, L_{st} (mm)	Stress Developed in Steel, $\sigma_{st(nom)}$ (MPa)						
75	163						
100	217						
125	272						
150	326	242					
175	380	282					
205	446	331					
230	**500**	371	256				
255	554	411	283				
285	620	460	317				
310	674	**500**	344	265			
355	772	573	394	303			
405	880	653	450	346			
450		726	**500**	385	280		
495		798	550	423	307		
540		871	600	462	335		
585			650	**500**	363	283	
660			733	564	410	319	
735			817	628	457	355	
805				688	**500**	389	297
880				752	547	425	325
960				821	596	464	354
1035					643	**500**	382
1140					708	551	421
1250					776	604	461
1355						655	**500**
1460						705	539
1565						756	577
1670							616
1775							655
1880							694





500 = denotes tensile steel yield stress. Interpolations permitted. Do not extrapolate.

See deformed bar worksheet, Page 104 for calculating process.

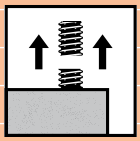
Chemset™ C8 Extreme / REO 502

Design Case 4 All Other Longitudinal Bars (AS3600 - 2001, clause 13.1.2.1)

Concrete Splitting Factors	
k_1	1.0
k_2	2.4

For Example
Bars in walls and floors with ≤ 150mm clear spacing. Longitudinal bars in beams and columns without figments.

Table 4 Stress in Steel, σst at selected effective length, L_{st}

Rebar Size	10	12	16	20	25	32	40
Drilled Hole Dia, d_h (mm)	14	16	20	25	30	40	50
Minimum Cover, e (mm)	30	30	32	40	50	64	80
Minimum Clear Spacing, a (mm)	40	48	64	80	100	128	150
Reduced Ultimate Tensile Adhesive Bond Capacity ΦN_{ub}, (kN), Φ_c = 0.6	39.3	56.5	100.5	157.0	245.5	402.0	630.0
Nominal development length of bar in tension, Lsy.t (nom) (mm)	250	335	490	635	875	1,130	1,475
Effective Length, L_{st} (mm)	Stress Developed in Steel, $\sigma_{st(nom)}$ (MPa)						
75	150						
105	210						
135	270						
165	330	246					
195	390	291					
225	450	336					
250	**500**	373	255				
280	560	418	286				
310	620	463	316				
335	670	**500**	342	264			
385	770	575	393	303			
440	880	657	449	346			
490		731	**500**	386	280		
540		806	551	425	309		
590		881	602	465	337		
635			648	**500**	363	281	
715			730	563	409	316	
795			811	626	454	352	
875				689	**500**	387	297
960				756	549	425	325
1045				823	597	462	354
1130					646	**500**	383
1245					711	551	422
1360					777	602	461
1475						653	**500**
1590						704	539
1705						754	578
1820							617
1935							656
2050							695

500 = denotes tensile steel yield stress. Interpolations permitted. Do not extrapolate.

See deformed bar worksheet, Page 104 for calculating process.