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Anchor testing to TS101:2015 Appendix B performed by ramsetreid™ Concrete Structures Laboratory, an ISO 9001 Accredited Laboratory
Report Number: TR16047

Fastener Technical Assessment

FTA-17/0002
of 01/05/2017

This Technical Assessment meets the testing requirements stipulated in Standards Australia Technical Specification: SA TS101:2015

Trade name of the construction product	ChemSet™ Reo 502™ Pure Epoxy steel bonded anchor
Product family to which the construction product belongs	Bonded injection type anchor for use in non-cracked concrete
Manufacturer	ramsetreid™ 1 Ramset Drive Chirnside Park Vic 3116 Australia
Manufacturing plant	ITW Australia Pty Ltd (ramsetreid™)
This Technical Assessment contains	13 pages including 10 Annexes which form an integral part of this assessment.
This Technical Assessment is issued in accordance with Standards Australia SA TS101:2015, based on	Compliance to testing for suitability and admissible service conditions in accordance with SA TS101:2015 Appendix B

1. Technical description of the product

The ChemSet™ Reo502™ (faster curing time) and ChemSet™ Reo502™EF (extended processing time) is used with steel elements as a bonded anchor (injection type).

Steel elements in this report are Metric Threaded bars.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete. The anchor is intended to be used with embedment depth from 7 bar diameters to 20 bar diameters.

The illustration and the description of the product are given in Annex A.

2. Specification of intended use

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The provisions made in this Technical Assessment are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the products in relation to the expected economically reasonable working life of the works.

3. Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability

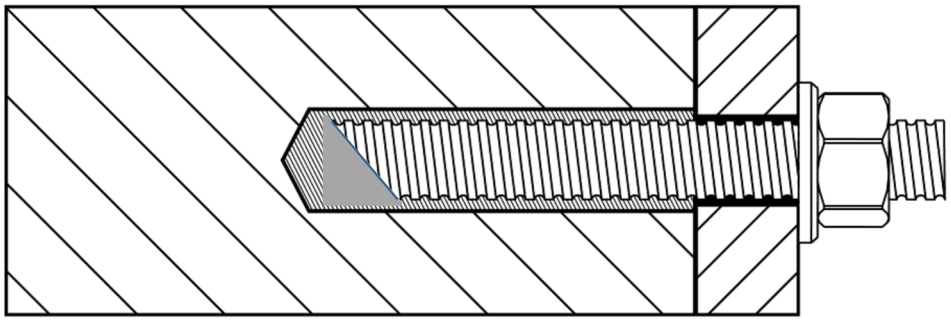
Essential characteristic	Performance
Characteristic resistance for tension loads – threaded bar	See Annex C1
Characteristic resistance for shear loads – threaded bar	See Annex C2
Characteristic values for displacement – threaded bar	See Annex C3

The information published in this document reflects a true representation of performance in typical Australian and New Zealand concrete substrates including Flyash.

4. Material Safety Data Sheet

Refer to MSDS Chemwatch 41-8662 (Reo502) and Chemwatch 4784-68 (Reo502EF) for Safety Data Sheet per WHS and ADG requirements.

Metric Threaded bar



ChemSet™ Reo 502™, ChemSet™ Reo 502™EF	**Annex A 1**
Product description Installed conditions	

Coaxial cartridge (Coax)

ChemSet™ Reo502™ 600 ml

ChemSet™ Reo 502™EF 600 ml

Marking of the mortar cartridges

Identifying mark of the producer, Trade name, Part/Order number, Storage life, Curing and processing time

Mixing nozzle

S055 838
S055 837

ISNE

Dosing Cap

Dosing Cap			
Description	To Suit Hole Diameters	Part Number	Pack Quantity
Dosing Cap	15, 18, 20, 25, 30, 40 mm	055969	5

ChemSet™ Reo 502™, ChemSet™ Reo 502™EF	**Annex A 2**
Product description Injection system	

Metric Threaded bar M12, M16, M20, M24

Commercial metric threaded rod with marked embedment depth

Product Characteristics	**Value**
Characteristic yield strength f_{yf} (MPa) "Grade 4.6" EN ISO 898-1	240
Characteristic Minimum Ultimate to Yield ratio - f_{uf}/f_{yf}	1.06
Characteristic yield strength f_{yf} (MPa) "Grade 5.8" EN ISO 898-1	400
Characteristic Minimum Ultimate to Yield ratio - f_{uf}/f_{yf}	1.08
Characteristic yield strength f_{yf} (MPa) "Grade 8.8" EN ISO 898-1	640
Characteristic Minimum Ultimate to Yield ratio - f_{uf}/f_{yf}	1.08
Characteristic yield strength f_{yf} (MPa) "Grade 10.9" EN ISO 898-1	900
Characteristic Minimum Ultimate to Yield ratio - f_{uf}/f_{yf}	1.10
Characteristic yield strength f_{yf} (MPa) Stainless Steel "Grade A4" EN 10088-3	450
Characteristic Minimum Ultimate to Yield ratio - f_{uf}/f_{yf}	1.45

Specifications of intended use

Anchorages subject to:

- Static and quasi-static load.

Base materials

- Non-cracked concrete for Threaded rods M10 to M24.
- Reinforced or unreinforced normal weight concrete per AS1379:2007 of strength class f'_c = 20 MPa at minimum and f'_c = 50 MPa at maximum for use in construction in accordance with AS3600:2009.

Temperature range:

- -40°C to +40°C (max. short. term temperature +40°C and max. long term temperature +24°C)

Use categories:

- Category 2 – installation in dry or wet concrete or in flooded hole.

Design:

- The anchorages are designed in accordance with the Standards Australia SA TS101:2015 "Design of post-installed and cast in fixings" under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared considering the loads to be anchored. The position of the anchor is indicated on the design drawings.

Installation:

- Dry or wet concrete or flooded hole.
- Hole drilling by hammer drill mode or diamond core drill mode.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

ChemSet™ Reo 502™, ChemSet™ Reo 502™EF	**Annex B 1**
Intended use Specifications	

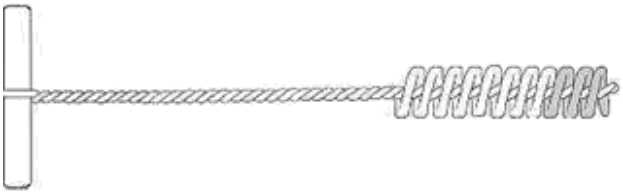
Applicator gun

A

A1

Applicator gun	A	A1
Cartridge	Coax 600	Coax 600

Cleaning brush

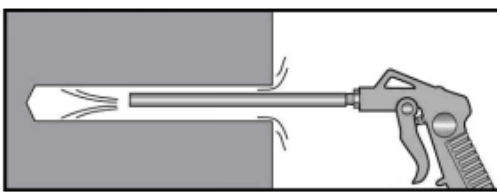


Pump

Vacuum

Dustless Drill Bit

Compressed Air



ChemSet™ Reo 502™, ChemSet™ Reo 502™EF	
Intended use Applicator Gun Cleaning Brush , Pump, Vacuum, Compressed Air, and Dustless Drill Bit	**Annex B 2**

Installation Details – Drilling


Drilled holes


Cored holes

- Consult engineers drawings for hole dimensions; otherwise refer to table 1 (Post Installed Rebar), table 2 (Threaded Bar) and table 3 (Threaded Inserts).
- Refer to product information in this book for approved drilling methods for each anchoring product.
- Drill hole to specified dimensions using carbide or diamond core as appropriate.
- Ramset™ Dustless Drilling System is recommended as the fastest most certain method of removing drilling debris and dust and eliminates post-drilling hole cleaning.
- Otherwise drilling debris and dust must be removed by brushing and blowing out of drilled holes as described below.

Hole Cleaning – Carbide Drilled

Dust removal and cleaning is not required with Ramset™ Dustless Drilling System.

Drilling debris and dust must be removed from holes drilled with standard carbide as follows:

1. Using Ramset™ blower (Part Number HCPHV), compressed air blast or wet / dry vacuum (Ramset™ AC1630P), remove dust with 2 swift pumps.
2. Using the appropriate sized brush (Refer Page 33), with a twisting / rotating motion, insert brush to the bottom of the hole and remove 2 times.
3. Remove remaining dust residue with air blower (2 pumps), compressed air blast or wet / dry vacuum.
4. For non-epoxy products (ChemSet™ 101, ChemSet™ 801, StructaSet™ 401 and UltraFix Plus), repeat steps 2 and 3.

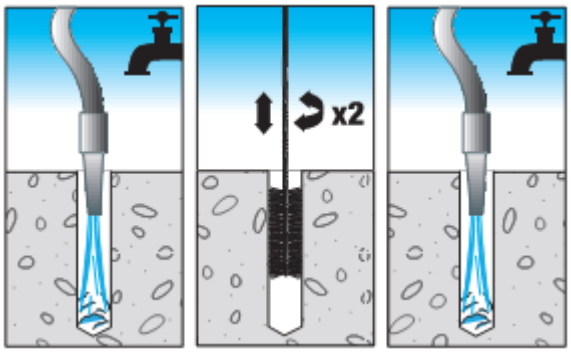
Hole Cleaning – Core Drilled or Flooded Holes

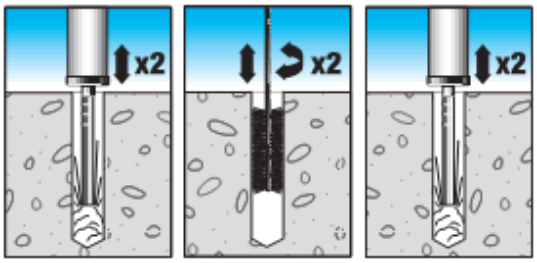

Cored holes


Flooded holes

Remove dust and drilling debris from Core drilled or flooded holes as follows:

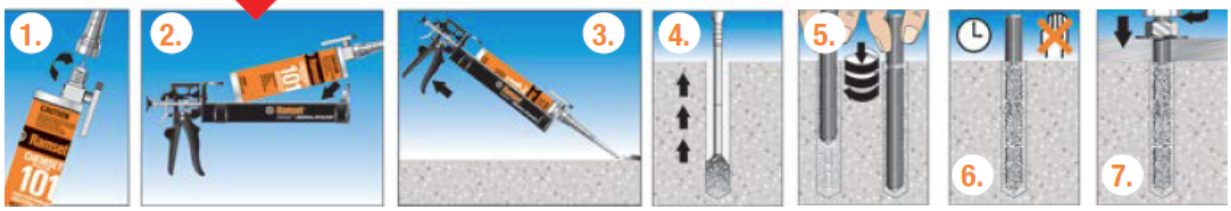
1. Flush holes with clean running water until water is clear.
2. Using the appropriate sized brush (Refer Page 33), with a twisting / rotating motion, insert brush to the bottom of the hole and remove 2 times.
3. Flush holes with clean running water until water is clear.





Installation instructions (cont'd)

Opening And Using Cartridge



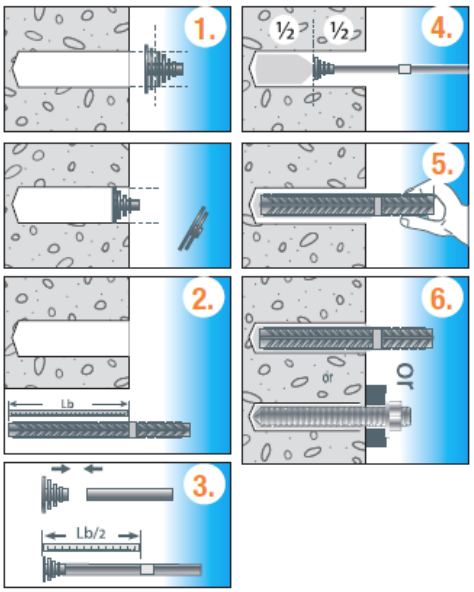
1. Remove cap from cartridge and attach mixing nozzle. Refer to product label for correct part number.
2. Load cartridge into dispensing gun (Ramset Part Numbers CUAP (Manual), E108 (Manual), CUAPN (Pneumatic) and CUAR18 (18V Battery Powered)
3. Dispense a small quantity of adhesive (2 to 3 trigger pulls) to waste to ensure both adhesive components are balanced.
4. Insert mixing nozzle tip to bottom of hole (to avoid air bubbles) and inject adhesive. Gradually withdraw nozzle to keep the nozzle tip at the surface of the adhesive Continue injecting until hole is about ¾ filled.
5. Insert fixing using a twisting / rotating motion into adhesive and wipe away any excess. **Note: For flooded holes, insert fixing using a pushing motion**
6. Allow adhesive to cure. Refer to product label or product pages in this book or Technical Data Sheets for curing times at various temperatures.
7. Load anchor and apply torque (to threaded fixings) after appropriate cure time.

Avoid trapping air bubbles. Air bubbles reduce the bonded area resulting in a lower load capacity

Deep Embedment

- For deep holes up to 425 mm, use an extension tube (included with ISNE mixing nozzles).
- For holes deeper than 425mm, use flexible pvc tube with a Ramset Dosing Cap (Part Number 050969).

1. Break off larger discs from Dosing Cap to obtain the correct diameter
2. Measure depth of hole.
3. Attach dosing cap to end of extension tube. Measure and mark half the hole depth on the extension tube.
4. Insert extension tube to end of hole and inject adhesive. Adhesive in the hole will apply force to the disc, pushing it back. Stop injecting when mark on tube appears.
5. Insert rod or bar with a twisting / rotating motion. Wipe away any excess adhesive.
6. Load anchor and apply torque (to threaded fixings) after appropriate cure time.



ChemSet™ Reo 502™, ChemSet™ Reo 502™EF	Annex B3
Intended use	

Table B1: Installation parameters of threaded rod

Size			M10	M12	M16	M20	M24
Nominal drill hole diameter	d_0	[mm]	12	14	18	24	26
Diameter of cleaning brush	d_{brush}	[mm]	13	15	20	26	30
Depth of drill hole – min	$h_{ef,min}$	[mm]	70	84	112	140	168
Minimum edge distance	c_{min}	[mm]	-	45	60	70	85
Minimum spacing	s_{min}	[mm]	-	45	60	70	85
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 ≥ 100			h_{ef} + $2d_0$	
Depth of drill hole – max (20xd)	$h_{ef,max}$	[mm]	200	240	320	400	480
Minimum edge distance	c_{min}	[mm]	-	45	60	70	85
Minimum spacing	s_{min}	[mm]	-	45	60	70	85
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 ≥ 100			h_{ef} + $2d_0$	

Table B2: Cleaning

All diameters
- 2 x blowing
- 2 x brushing
- 2 x blowing

Table B3: Minimum curing time

ChemSet™ Reo502™			
Application temperature	**Processing time**	**Load Time**	
		Dry/Wet	**Flooded**
+5 to +10°C	-	-	-
+10 to +15°C	27 mins	8 hours	48 hours
+15 to +20°C	23 mins	5 hours	32 hours
+20 to +25°C	20 mins	3 hours	24 hours
+25 to +30°C	12 mins	2.5 hours	15 hours
+30 to +40°C	8.5 mins	2 hours	12 hours

Processing time refers to the highest temperature in the range. Load time refers to the lowest temperature in the range.
Cartridge must be conditioned to a minimum +15°C.

ChemSet™ Reo502™EF			
Application temperature	**Processing time**	**Load Time**	
		Dry/Wet	**Flooded**
+5 to +10°C	32 mins	96 hours	240 hours
+10 to +15°C	22 mins	48 hours	160 hours
+15 to +20°C	17 mins	22 hours	115 hours
+20 to +25°C	13 mins	12 hours	85 hours
+25 to +30°C	-	-	-
+30 to +40°C	8.5 mins	6 hours	48 hours

Processing time refers to the highest temperature in the range. Load time refers to the lowest temperature in the range.
Cartridge must be conditioned to a minimum +5°C.

ChemSet™ Reo 502™, ChemSet™ Reo 502™EF

Intended use Installation
Parameters Curing time

Annex B 4

Table C1: Design method SA TS101:2015
Characteristic values of resistance to tension load of threaded rod

Steel failure – Characteristic resistance							
Size			**M10**	**M12**	**M16**	**M20**	**M24**
Characteristic resistance "Grade 5.8"	$N_{rk,s}$	[kN]	29	42	79	123	177
Characteristic resistance "Grade 8.8"	$N_{rk,s}$	[kN]	46	67	126	196	282
Characteristic resistance "Grade 10.9"	$N_{rk,s}$	[kN]	58	84	157	245	353
Characteristic resistance A4 – Anchor stud	$N_{rk,s}$	[kN]	30	44	87	131	189
Capacity reduction factor	$\emptyset_{Ms}$ [1)]	[-]	0.8				

Combined pullout and concrete cone failure in non-cracked concrete f'c = 20 MPa							
Size			**M10**	**M12**	**M16**	**M20**	**M24**
Characteristic bond resistance in non-cracked concrete							
Dry and wet concrete	τ_{Rk}	[N/mm²]	12	12	11	10	9
Capacity reduction factor Reo 502™	$\emptyset_{Mp} = \emptyset_{Mc}$ [1)]	[-]	0.46 [2)]				
Capacity reduction factor Reo 502™EF	$\emptyset_{Mp} = \emptyset_{Mc}$ [1)]	[-]	0.56 [2)]				
Flooded hole	τ_{Rk}	[N/mm²]	12	12	11	10	9
Capacity reduction factor Reo 502™	$\emptyset_{Mp} = \emptyset_{Mc}$ [1)]	[-]	0.32 [3)]				
Capacity reduction factor Reo 502™EF	$\emptyset_{Mp} = \emptyset_{Mc}$ [1)]	[-]	0.39 [3)]				
Factor for concrete f'c= 50 MPa	$\psi_{Mc} = \psi_c$	[-]	1.0	1.27	1.27	1.27	1.27

Concrete cone failure							
Size			**M10**	**M12**	**M16**	**M20**	**M24**
Factor according to SA TS101:2015 Section 6.2.2.2	$k_{ucr,N}$		11.0				
Edge distance	$c_{cr,N}$	[mm]	$1.5h_{ef}$				
Spacing	$s_{cr,N}$	[mm]	$3.0h_{ef}$				
Capacity reduction factor Reo 502™	$\emptyset_{Mp} = \emptyset_{Mc}$ [1)]	[-]	0.46 [2)]				
Capacity reduction factor Reo 502™EF	$\emptyset_{Mp} = \emptyset_{Mc}$ [1)]	[-]	0.56 [2)]				

Splitting failure							
Size			**M10**	**M12**	**M16**	**M20**	**M24**
Edge distance	$c_{cr,sp}$	[mm]	$1.5h_{ef}$				
Spacing	$s_{cr,sp}$	[mm]	$3.0h_{ef}$				
Capacity reduction factor Reo 502™	$\emptyset_{Mp} = \emptyset_{Mc}$ [1)]	[-]	0.46 [2)]				
Capacity reduction factor Reo 502™EF	$\emptyset_{Mp} = \emptyset_{Mc}$ [1)]	[-]	0.56 [2)]				

[1)] In absence of national regulations
[2)] The capacity reduction factor for installation $\emptyset_{inst}$ = 0.83 is included
[3)] The capacity reduction factor for installation $\emptyset_{inst}$= 0.71 is included

ChemSet™ Reo 502™, ChemSet™ Reo 502™EF

Performances
Design per SA TS101
Characteristic resistance for tension loads – threaded bar

Annex C 1

Table C2: Design method SA TS101:2015
Characteristic values of resistance to shear load of threaded rod

Steel failure without lever arm							
Size			**M10**	**M12**	**M16**	**M20**	**M24**
Characteristic resistance "Grade 5.8"	$V_{Rk,s}$	[kN]	15	21	39	61	88
Characteristic resistance "Grade 8.8"	$V_{rk,s}$	[kN]	23	34	63	98	141
Characteristic resistance "Grade 10.9	$V_{rk,s}$	[kN]	29	42	79	123	177
Characteristic resistance A4 – Anchor stud	$V_{rk,s}$	[kN]	21	32	62	94	136
Capacity reduction factor	$Ø_{Ms}$ [1)]	[-]	0.67				

Concrete pry-out failure			
Factor k_8 from SA TS101:2015 and current experience TR 029 Design of bonded anchors, Part 5.2.3.3			2
Capacity reduction factor	$Ø_{Mp}$	[-]	0.67

Concrete edge failure							
Size			**M10**	**M12**	**M16**	**M20**	**M24**
See section 7.2.2 of SA TS101:2015							
Capacity reduction factor	$Ø_{Mc}$ [1)]	[-]	0.67				

[1)] In absence of national regulations

Table C3: Design method SA TS101:2015
Characteristic values of displacement to long term loading of threaded rod

Displacements under tension loads[1], for threaded rods							
ChemSet™ Reo502™			**Threaded rods**				
Non-cracked concrete Temperature range I: 40⁰C/24⁰C			**M10**	**M12**	**M16**	**M20**	**M24**
Displacement	δ_{N0}	[mm/(N/mm²)]	0.078	0.078	0.085	0.094	0.104
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0.108	0.108	0.118	0.130	0.144

ChemSet™ Reo502™EF			**Threaded rods**				
Non-cracked concrete Temperature range I: 40⁰C/24⁰C			**M10**	**M12**	**M16**	**M20**	**M24**
Displacement	δ_{N0}	[mm/(N/mm²)]	0.060	0.060	0.065	0.072	0.079
Displacement	$\delta_{N\infty}$	[mm/(N/mm²)]	0.095	0.095	0.104	0.114	0.127

1) Calculation of displacement under tension load: τ_{sd} (MPa) design value of bond stress
Displacement under short term loading = $\delta_{N0} \cdot \tau_{sd} / 1.4$
Displacement under long term loading = $\delta_{N\infty} \cdot \tau_{sd} / 1.4$