



## 2014 Innovan XC - Xpedition Caravan

The following section provides a detailed overview of the major functions and features available within the innovan XC Caravan. For your convenience we have also linked these descriptions with the feature, function or optional line items found on the Caravan Product Enquiry Form. For example, A1 below refers to the A1 line item outlined within the enquiry form and associated investment.

### Section A

**A1.** The GRP which is commonly referred to as “fibreglass” allows strong and comparatively light construction and the ability to provide a smooth aerodynamic shape. Fibreglass is the material of choice when building racing yachts that are required to have minimal drag and yet be able to withstand gigantic seas and gale force winds.

The Innovan XC caravan is constructed from many moulded parts but the three, main fully moulded components are the base, the furniture, and the roof. The base and the furniture are bonded together with a second floor 300 mm above the bottom floor. These two floors are moulded with storage compartments which when bonded together, form a structure which is much stronger than a conventionally built caravan of the same weight. The roof has sandwiched type construction with a layer of PVC honeycomb material between two layers of fibreglass. This provides excellent insulating properties as well as the combination of strength and lightness.



Innovan has not experienced any structural failures with the fibreglass even though a number of the units have travelled more than 100,000 km and have been used on some of Australia's roughest tracks.



An early Innovan caravan prototype on test in remote Far North Queensland

**A2.** In the Innovan XC, the axis through the bushes which support the trailing arm is not parallel to the axle, but is positioned at an angle so that even though the van may lean when cornering or changing direction, the wheels will stay vertical with the full footprint of rubber on the road. This is similar geometry to what you would find in the rear suspension of a modern Holden Commodore, but not in the typical Australian made caravan or camper trailer.



**A3.** The trailing arm suspension has the same bushing that you would find on Holden V8 supercars and can be adjusted for wheel alignment. However, the steelwork surrounding the bushes and in the trailing arms is much stronger.



**A4.** The 2000 kg bearings and the 50mm x 50mm square axles are the heaviest off-the-shelf product that Innovan could locate. In the left-hand photo below, compare the damaged 1600 kg parallel bearing axle which is often used in trailers with the one that it is resting upon – the one used by Innovan in the XC. The axles, brakes and hubs are provided by AL KO – a well-known, reliable, nationwide supplier of advanced trailer components.



**A5.** Airbags provide a softer ride than steel springs and they also allow a variation in height. Ground clearance can be increased to negotiate rutted tracks or obstacles in the path or for crossing streams. The unit can be lowered to go under branches or to enter storage areas. Airbags also make it easy to level the van for sleeping or for cooking or even changing a wheel with a flat tyre. The Innovan is probably the only caravan on the market where the GMV is almost twice the tare weight (the load that can be added is almost the same as the weight of the unit when it is empty). The airbags allow the van to be at the required height no matter what the load. Steel springs on the other hand are optimised for one load only. The photo below shows the wheel on the curb retracted a little and the wheel on the bitumen with the airbag extended more, so that the van still sits level.



**A6.** As can be seen in the photograph above, the high lift suspension has the axle located 150 mm below the main RHS sections of the trailing arms.

**A7.** The shock absorbers in the XC caravan, as can be seen in the photograph above, are mounted vertically to give optimum performance unlike so many caravans or camper trailers on the Australian market, where shock absorbers are situated at an angle of about 45° to the horizontal. Chains, rather than cables or straps, are fitted to prevent over extension.

The shock absorbers used are the Pedders 9500 series designed for off-road use. These foam cell “track rider” shocks, have a huge 40 mm bore that further minimizes fade. They also allow more precise valve settings for unrivalled performance, without compromising comfort.

**A8.** The hydraulically operated disc brake (as can be seen in the photos above) is the type of brake that you would expect to find on a modern, high-quality car. In the off-road situation, drum brakes are more prone to the effects of dust. Electrical wiring associated with drum brakes is also prone to damage from sticks or stones and is also subject to chemical deterioration over time. The electrical controller for drum brakes also needs to be set properly at all times.

In the Innovan XC, the hydraulic lines are now run inside the van so they are protected from sticks and stones. Only the flexible part that moves with the trailing arm is exposed and even that is largely protected by the trailing arm. With the override system, the disc brakes are self adjusting under dynamic loads and this allows the vehicle’s brakes and trailer’s brakes to perform at their maximum in emergency conditions, without the need for any adjustment by the driver.

**A9.** The coupling currently used is supplied by Al-KO International, a well-known and respected manufacturer. Their off-road coupling will fit onto any 50 mm tow ball. In testing, we have found it easy to attach or detach in any situation, unlike some pin type couplings tested, which are virtually impossible to undo at times, especially when the units have been bogged. It has a very low profile, so the back door of a towing vehicle is not likely to foul it. The handbrake mechanism is tidy, reliable and unobtrusive. The wearing parts are replaceable. Greasing is well catered for with two grease nipples that are easily accessed. The removable locking ring is a big help in holding the head in the right position for attachment. The locking mechanism is easy to use and seems very secure.



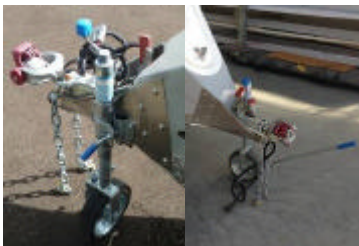
**A10.** The 16 inch wheels chosen as standard are used extensively on four-wheel drive vehicles which are often used in extreme conditions. The tyres are readily available in outback/regional areas. The six stud, 80 Series Landcruiser stud pattern is strong and is compatible with a large number of other vehicles which can include the Hilux, Prado, Patrol, Navara, Colorado, Rodeo, Pajero, Triton, Izuzu, Courier, Ranger and BT 50. ROH 4x4 wheels are made in Australia to the demanding standards of Toyota. The Sunraysia Wheels offer some stud patterns which are not available in the ROH range.

The offset for the 80 Series LandCruiser makes it more likely to be able to be used on the tow vehicle (provided that it has the same stud pattern) than one with a large, negative offset.

The 16 inch wheels with this offset is the standard but other options might be available, if a client wanted to match the wheels on the caravan with those of the towing vehicle, to increase the availability of a spare wheel for either.



**A11.** This jockey wheel has the AI KO quality and backup. An 8 inch wheel is easier to move over a surface than a 6 inch wheel. The solid rubber jockey wheel is not subject to deflation. It can be easily removed and stored inside the van, so it is not subject to fouling some object and being torn off.



**A12.** LED lights will stand up to the rigours of corrugations. The tail lights used have a lifetime warranty.



**A13.** The pneumatic rams that are currently used to assist in the raising of the Innovan roof are made in Australia and are the best quality struts that Innovan could locate. The amount of pressure in the struts can be tailored to achieve the optimum effect and replacement parts are readily available should they be needed. The aim is to pressurize the struts, so that very little effort is required to lift the roof and have the roof stay up, once it is raised.



The pressure in the struts also needs to be such that the roof is not too hard to pull down and that it will stay down once it has been lowered.

There is now an option to use 12 volt actuators to raise or lower the roof using a toggle switch, or at an extra cost, a hand held remote controller.



Image reference: <http://www.directindustry.com/prod/linak/electric-linear-actuators-solar-panels-7052-376361.html>

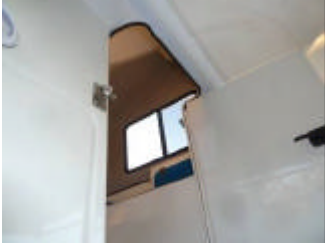
The pressure in the gas struts connected to the beds is such, that when the beds are down they will stay down, but if the latch at the back of the bed is undone, then the top part of the bed and the mattress will be raised to the roof, thus allowing access to whatever is stored in the bed. When the two halves of the bed are latched together, the gas strut assists in raising the mattress, the bed and the contents of the bed up to the roof, so that the seats, stove and fridge can be accessed and the table pulled out.



**A14.** When the roof is pulled down, an automotive seal on the return at the bottom of the roof sits on a ledge protruding out from the base. This prevents dust getting into the inside of the caravan in the same way that a door seal would prevent dust getting into a vehicle. When the roof is raised, another automotive seal which is fixed to the top of the base and furniture parts makes contact with the roof to prevent entry of insects.



**A15.** The main entry door is unusual in that, as well as having a vertical section like most doors, it also has a horizontal protrusion at the top of the door which covers an open section behind the doorway. The effect is similar to having a “man hole” over the top of the doorway, so entering the Innovan does not require bending over to go through the doorway. An upright stance can be maintained by walking up the steps through the “man hole”. This door can be locked from the outside with a key which is different from the storage compartment keys. From inside the van, the door can be locked by simply lifting up the lever type handle.



**A16.** In the standard innovan Xpedition there are three individual filling ports (one for each of the tanks) located in the vanity cabinet which is lockable.



**A17.** All the storage doors (including the gas storage compartment) are keyed alike, so there is no need for the identification of various keys for individual locks.



**A18.** Each stair tread is more than 200 mm wide with ribs to prevent slipping. When unfolded the staircase locks firmly against the back of the van. When the staircase is folded up, it locks against the awning to prevent the awning from rattling.



**A19.** When the beds are raised and people are occupying the seats, the dining table can be rolled out to a position between the occupants in the seats. By raising the outside edge of the table, it can be locked in place. This is useful if the van is facing downhill. The latest seat design has a fold down backrest which when folded up, provides a very comfortable sitting position.



**A20.** The two standard, single mattresses are made from top-quality foam. Each is half the width of a Queen-size bed. They are 1880 mm long but for really tall people, the space at the end of the bed can be utilised for a pillow, because the height of the bench space located at the end of each bed, is a similar height to the top of each mattress.



**A21.** In a conventional caravan or camper trailer, the A-frame usually carries a stone deflector. The stone deflector creates considerable wind resistance as well as often having a tendency to deflect rocks forward to smash the rear window of the towing vehicle. In the XC caravan, the area where the A-frame would be found on other caravans is a storage area. The storage area behind the gas bottles is, in places, more than a metre deep and extends right through to the back of the van. Some of the space is occupied by the tops of the wheel arches and, if they are fitted, the fridge and slide out kitchen. This space can be accessed from the sides by four large doors and one smaller door and there is another large door at the back. There is also access to this area from inside the van by lifting the seats.



In addition to this open area described above, there is also a 300 mm deep space between the two floors. This runs from the gas compartment to the back of the van. It contains three water tanks, a spare tyre well which can cater for a 900 mm diameter tyre, a hot water compartment, a battery compartment, a plumbing compartment and five other accessible compartments that can be used for general storage or specialised equipment such as an air tank and air compressor. The two back compartments have lockable doors which open to the exterior of the van.

All the internal storage compartments between the floors have removable covers.



There are normally 13 storage compartments that can be accessed from inside the living area of the van. The beds each have about 160 L of storage space under the mattress. At the front there are two storage wells either side of the table and a well underneath the table, two storage compartments behind the seats and two storage cupboards with hinged lift up doors at the back of the van. Also, at the back of the van, there is a storage compartment that is very useful for storing cooking utensils as it can be accessed from outside through a door or on the inside of the van by lifting a hinged cover. In addition, there is an overhead storage compartment above the front window with a hinged, drop down door.

A storage well under the table provides a convenient location for storage of items such as computers, phones and reading material. Probably more importantly it provides a convenient location for power points such as 12 Volt cigarette lighter type power points to operate 12 Volt appliances or an inverter to convert 12 Volt DC to 240 Volt AC electricity as well as a 240 Volt power point to operate from either a mains supply or a generator.

The front wells are covered by the beds when they are down and by the table when it is pushed in, so covers are unnecessary and would be a hindrance. The two storage compartments behind the seats have lift off covers.





**A22.** A lockable gas storage compartment reduces the chances of the gas bottles being stolen or tampered with when the van is unattended. The aerodynamic shape created by the storage area results in considerable fuel savings. All lockable storage compartments are keyed alike so there are 10 spare keys supplied with each XC Caravan.



**A23.** The beds are hinged at the front so that they can lie horizontal for sleeping. A gas strut passes through the bottom and pushes against the lid. When the lid is unlatched, it and the mattress are pushed up against the roof allowing access, at a convenient height, to the contents of the “suitcase”. When the two halves of the bed are locked together, the gas struts enable the whole bed including its contents and mattress to be raised effortlessly to the roof.



**A24.** Behind each of the seats is a storage compartment with a removable lid.



**A25.** The storage compartment referred to as a “utensils’ storage compartment” is a convenient location for cooking items such as frying pans, kettle, saucepans etc. There is access to this area from inside the van if the internal cook top is being utilized as well as access from the outside, if the outside kitchen is being used.



**A26.** The hinged lid of the “utensils’ storage compartment” is positioned at a convenient height to function as a food preparation workbench. A cutting board could be placed on the surface and any liquid residue that flowed over the edge would be trapped in a groove below the lid, thus preventing spillage into the storage compartment below.



**A27.** If the external kitchen is NOT fitted to the unit, then the space between the utensils’ storage compartment and the floor can be used as a general storage area. If the external kitchen is fitted, it occupies the top part of this area and there is a storage area running underneath the external kitchen right through to the gas storage compartment at the front of the van. (Photo above)

**A28.** There are two storage cupboards located on either side of the van immediately inside the main door. On one side, the cupboard is found above the back part of the utensils’ storage compartment and on the other side, it is located above and behind the sink/drain. The doors to both cupboards have hinges at the top and a pop-out and rotate button latch at the bottom.



**A29.** The door of the vanity recess has a similar lock to that found on the other storage compartments.

**A30.** The inside of the vanity door is a convenient place to fix a mirror if the mirror is being used for personal grooming tasks.



**A31.** When the caravan is connected to the towing vehicle there are two electrical systems that need to be connected. The flat, seven pin plug connects the system which operates the taillights, brake lights, indicator lights and clearance lights.

An Anderson plug connects a 12 Volt wiring loom that operates the 12 Volt sockets and lights in the van to the alternator or second battery in the towing vehicle. The connecting Anderson plug would be located at the back of the vehicle near the seven pin plug.



**A32.** The two pin 12 Volt outlet socket is fitted at the front of the van between the two beds if there is no well under the table.

If a storage well area is located under the table, then a cigarette lighter type socket is attached to the front of this well. This is a convenient position to plug in an inverter which would convert 12 Volt into 240 Volt for the use of a computer/TV which might also be stored in this location.



**A33.** LED lights use a lot less electrical energy than conventional lights and they produce much less heat and so will not cause a burn or a fire as other types of bulbs might do. All the lights in the XC Innovan are LED lights. There are two lights located on the outside of the back wall under the awning, two in the storage compartment and in the interior of the unit, there are six adjustable reading and work lights and one strip light.



**A34.** The centre console is an ideal place to store magazines, books, spectacles, a torch etc. It could also be used to house audio equipment. Speakers could be placed in this compartment or lower down on the wall section of this moulding.



**A35.** The front window is normally fitted so that the blind pulls up from the bottom. This allows for more privacy and also prevents splashes of rain coming into the unit. The screen and blind can be moved to the desired position and the double glazed window can be hinged out and locked in a number of positions.



**A36.** The back window provides light and ventilation at the back of the roof. It is above a height where privacy would be compromised. (Photo below)

**A37.** The back of the roof and the section forward of the back have a moulded gelcoat surface as does the area at the front of the unit, including the centre console. The remainder of the roof has a stretchable felt-like material (commonly known as Frontline or Hull Liner) covering the surface.



**A38.** A grab handle is located just inside the door and can be held in the left-hand during entry or exit. If the unit is exited backwards (facing forward into the van) an upright stance can still be maintained while passing safely through the doorway.



**A39.** The water pump engages automatically whenever a water tap or mixer is turned on. It is fitted with a stainless steel strainer.



**A40.** The water tanks are moulded into the floor and a sealing cover is placed over the open end which is at the bottom. Metal pipe fittings are glassed into the compartments. If the front two water tanks are used conjointly, then there will be no change in the tow ball weight even though the volume of water changes in the tanks.



**A41.** A system of taps and tubes is located in the back right hand corner compartment of the van. By either turning on or off various taps, a particular tank can be selected to supply the water to the pump. The photo below shows an option can be chosen from section C so that taps can also be used to direct water that is being pumped from an external source into a particular tank or tanks.



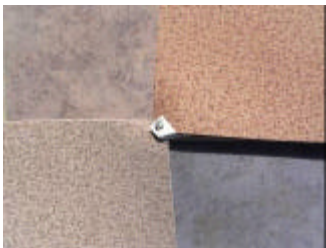
**A42.** The faucet in the vanity recess has a hot and cold water tap provided the hot water system is included in the options ordered.



**A44.** Having the glass lid of the sink drainer unit in the down position inside the van, increases the available bench area.



**A45.** “Walkertex” is a hard- wearing, attractive floor covering which can be easily removed from the van and hung over a clothesline and washed with a hose or a relatively high-pressure cleaner. Its rubber like backing prevents it from slipping on the floor and allows it to sit flat.



**A46.** All units are fitted with a fire extinguisher.



## Section B

**B1.** Two, 9 kg gas bottles can fit in the gas storage compartment of the XC caravan.



**B2.** Gas regulations require a vent near the floor when gas appliances are fitted internally. The vent in the back door satisfies this requirement.



**B3.** Gas regulations also require a vent to be located near or in the roof. This canopy hatch provides this ventilation and also allows light and some extra ventilation if required.



**B4.** The internal, three burner cook top has one burner large enough to cater for a large frypan, while still allowing plenty of room for a saucepan and kettle to be used on the other two burners. It has electric ignition for all burners so it is a matter of turning and holding in the knob, while just touching a switch rather than pushing a Piezo plunger to ignite the gas.



**B5.** The gas hot water system is located between the two floors of the caravan and is vented through the outside wall. The vent has a cover which prevents dust from entering the unit, but the cover must be removed to operate the hot water system. The ignition switch and the temperature control are located inside the caravan, on the front of one of the chest high cupboards. Below right image reference - <http://camec.com/truma-gas-elec-240v-14l-hws.html>



**B6.** The external kitchen pulls out from a storage space on the left-hand side of the entry door. It is mounted on 200 kg drawer runners and when pulled out, folds out further with two more movements. When unfolded the outside bench section contains a stainless steel sink. Beside this section, there is a stainless steel workbench and at a higher level, there is an area with a two burner cook-top, a stainless steel storage well and room for a barbecue. The appliances are connected to the gas supply of the caravan with the use of a removable bayonet type fitting on the end of a gas hose. This is a requirement to satisfy gas regulations. When not in use, the main body of the kitchen unit can be slid back into the recess, leaving just the workbench and the sink protruding.



**B7.** Being a marine barbecue, this unit will work well in windy conditions and will supply plenty of heat. It is usually mounted on the pull out kitchen behind the cook top and is connected to the gas system in the van with a bayonet type fitting.

Below right image reference - [http://www.sovereignbbqs.com/alpha\\_bravo.html](http://www.sovereignbbqs.com/alpha_bravo.html)



**B8.** The stainless steel Oven Wire insert replaces the grill plate to transform the barbecue so that it will operate more effectively as an oven.

Image reference - [http://www.sovereignbbqs.com/PhotoGallery/bbq\\_accessories.html](http://www.sovereignbbqs.com/PhotoGallery/bbq_accessories.html)



**B9.** The Truma E 2400 gas air heater would connect to the gas supply of the caravan, but would need an extra gas line and would be vented to the exterior of the caravan. It would be quieter and cheaper than the diesel equivalent and would not have the fumes that are associated with a diesel heater. This unit is 123 mm high, 248 mm wide and 370 mm long. The Innovan XC caravan has excellent insulating characteristics and it would be only in very cold weather conditions that most people would find it necessary to use a heater. Below image reference -

<http://www.truma.com/au/en/heating/trumatic-e-2400.php>

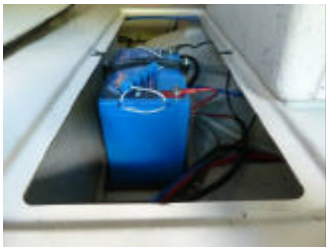


## Section C

**C1.** Wiring with a large cross-section is necessary to prevent build up of heat and voltage drop through the system. If the wire from the alternator or any other of source of energy is too small, then the energy of the electric current will be used up as the current travels through the wire. The wire will act in the same way as an electrical appliance and become hot and there will be a drop of voltage over the length of the wire. The voltage drop in the wire will increase with its length.

**C2.** Positioning the battery / batteries in the storage compartment at the back, left hand corner, frees up some extra storage space in the middle of the van between the floors, but perhaps more importantly, depending on the situation, reduces the weight on the tow ball.

**C3.** Even though they are more expensive, Innovan uses AGM (absorbed glass mat) deep cycle batteries. Our experience and available data indicate that, when compared with the conventional lead acid battery, AGM batteries can better withstand the rigours of corrugated roads; they will last longer if treated as any battery should be treated, they can be charged faster, they can be discharged to a lower level without serious damage, and because they are sealed, they do not expel acid or explosive gas into the caravan.



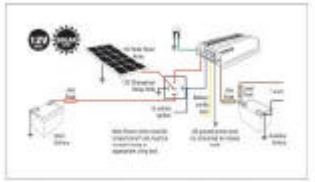
**C4.** If the intention is to stay in one place for an extended period of time and there is no means of charging the battery other than by using the alternator of the vehicle, then it might be worthwhile having a second battery. Cold conditions will also reduce the amount of energy available from a battery. Therefore, if you intend to spend a considerable amount of time in cold areas, it might be advisable to consider a second battery.

**C5.** A voltage booster is designed to ensure that the auxiliary battery can be fully charged, even if it is located a significant distance away from the starting battery. As described below, having the battery charged to 100% of its capacity could be expected to considerably increase the life of the battery.

An isolating switch should be included in the wiring system between the starting battery for the vehicle and any battery/batteries that operate the 12 V appliances in the caravan (lights, fridge, pump, inverter and compressor). All the batteries need to be connected to the alternator to be charged, but when the alternator is not operating, then the starting battery needs to be disconnected from the other batteries, otherwise the current will be drained from it and the vehicle may not be able to be started.



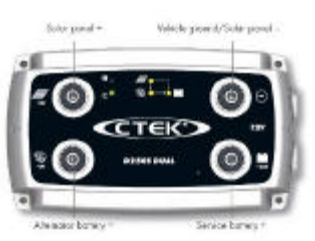
The usual situation is that the alternator charges a starting battery located close to the alternator in the vehicle. Wires connect the starting battery (and the alternator) to an Anderson plug at the back of the vehicle. Another Anderson plug near the front of the caravan has wires running to the battery or batteries located in the van. When the two Anderson plugs are joined together, these auxiliary batteries are able to be charged when the alternator is operating. There will be a drop in voltage as the current travels through the wire. The drop in voltage may be such that it is not sufficient to fully charge the batteries. To compensate for the voltage drop in the wire from the alternator, a voltage booster located near the caravan battery can boost the voltage (electrical pressure) so that the battery/batteries can be charged to full capacity. See wiring diagram below. Image reference - [http://www.exploroz.com/Forum/Topic/105504/how\\_to\\_connect\\_solar\\_to\\_a\\_bcdc1220\\_redarc.aspx](http://www.exploroz.com/Forum/Topic/105504/how_to_connect_solar_to_a_bcdc1220_redarc.aspx)



The CTEK D 250S Dual will boost the voltage, isolate the starting battery and also act as a regulator for solar panels. The below text and images have been referenced from ([http://www.ctek.com/Archive/ProductPdf/D250S%20DUAL\\_EN.pdf](http://www.ctek.com/Archive/ProductPdf/D250S%20DUAL_EN.pdf))

The D250S DUAL charger obtains its energy from DC sources such as alternators, solar panels or wind power and optimises this power to meet the charging requirements of different battery banks. The D250S DUAL automatically selects the best connected DC energy source (of 2) for the purpose and switches between these energy sources to achieve high efficiency multi-stage charging. The D250S DUAL is particularly suitable for charging vehicles that do not have access to grid power supplies. Charging automatically starts as soon as DC energy is provided to the charger, for example, from alternators when a vehicle is started or from solar panels when connected. The D250S DUAL ensures that your batteries are always in good condition, quick charging and have long battery lifetimes.

The D250S DUAL is a fully automatic 5-stage charger that supplies 20 A to 12 V batteries of 40–300 Ah. The charger is IP65 classified (water jet and dust protected and approved for outdoor use) and protects vehicle electronics. It is suitable for all types of lead-acid batteries (Wet, MF, Gel, AGM). It is supplied with a 2 year guarantee.



## TECHNICAL DATA

CHARGING VOLTAGE	14.4 V
CHARGING CURRENT	20 A
TYPE OF CHARGER	5 step, fully automatic charging cycle
TYPE OF BATTERY	12 V lead-acid batteries
BATTERY CAPACITY	40–300 Ah
INSULATION	IP65 (splash and dust proof)

## **FEATURES**

- Multi-step charging from alternators and solar panels
- Battery separator that eliminates diodes and VSR relays
- Maintenance charge of starter battery
- Solar panel regulator with Maximum Power Point Tracking, synchronised with other current sources such as the alternator and/or wind
- Simplified installation of remote batteries for bow thrust of anchor winch

## **BENEFITS**

- Maximised battery life due to minimised undercharge time
- Maximised battery capacity when the battery is kept fully charged avoiding harmful sulphate crystals on the lead plates and stratification of the battery acid.
- Ability to take charge automatically from any power source that is connected to the D250S DUAL
- Reduced charging times and costs by decreasing engine idling and the dependency on AC power onshore through efficient use of alternator and solar power
- Reduced environmental impact through extended battery life and a reduced idle time
- Minimal installation time and cost

## **FASTER CHARGING**

The D250S Dual is a 5-step charger that automatically adjusts the charging voltage and current according to the battery state of charge and temperature—reducing a battery's charge time.

A sensor on the CTEK charger senses the battery temperature and adjusts the required charge by increasing the voltage in cold weather ensuring the battery is fully charged, and dropping the voltage in hot weather to avoid the problems of overcharging.

With the D250S Dual , vehicle owners can be confident that their battery will always receive the optimal charging voltage, with reduced charge time and while ensuring the charging will be 100 % complete.

## SOLAR CONNECTION

The D250S Dual has the additional benefit of an auxiliary input which can be connected directly to solar panels without the need for a regulator, offering free power from the sun.

D250S Dual has a built-in Maximum Power Point Tracker (MPPT) that helps the solar cells produce power as efficiently as possible by taking the most efficient source of energy from the solar panels automatically, and then using the power to charge the battery.

The MPPT searches for the most effective combination of solar cell voltage and current, ensuring that the solar and alternator function work in unison to maximise power output.

Modern vehicles with a “Smart Alternator” need to be wired as in the second diagram.

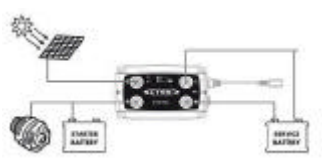
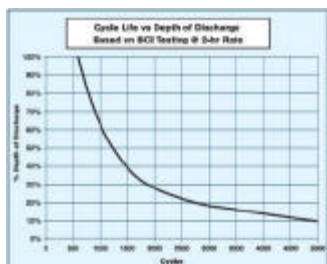


Image reference - [http://www.ctek-chargers.com.au/uploads/3/6/2/9/3629451/d250s\\_dual\\_en.pdf](http://www.ctek-chargers.com.au/uploads/3/6/2/9/3629451/d250s_dual_en.pdf)



The table below indicates that if you never discharged a battery by more than 20% (that is below 80% of its capacity) you would expect to get about 3000 charging cycles for the life of the battery. It also shows that if you discharge it by using 40% of its capacity (that is you discharge it to 60% of its capacity) then you could expect half the battery life experienced with the previous situation.

Experts say that to fully charge an AGM battery more than 14 V is required. If the output of the alternator or other energy provider is inadequate, or there is sufficient voltage drop in the wiring so that the voltage at the battery is less than the 14 V, then the battery will not become fully charged. Suppose you did not want to discharge your battery below 80% of its capacity and the available means of charging could only charge the battery to 90% of its capacity. In this scenario, the electrical energy that you would have at your disposal, would only be half of what it would be, if the battery had been charged to 100% of its capacity.



Reference required...

**C6.** The refrigerator/freezers used by Innovan are built by EvaKool at Caloundra in Queensland using their normal components. However, the compressor and fan are located underneath the box rather than at the end. Instead of the Danfos BD 35 compressor, the Innovan units have the BD 50 compressor which is normally used in the larger EvaKool units. EvaKool offers a five-year warranty and on the one occasion so far, that there was an issue with a unit, the backup from EvaKool was outstanding. The unit has a movable divider in the box so that the relationship between the amount of freezing space and the amount of refrigerator can be varied. Items in the freezing compartment can be frozen solid while food items such as milk, tomatoes and lettuce are kept in good condition without freezing in the other compartment. Removal of the partition enables the whole box to act as either a refrigerator or a freezer, by adjusting the temperature setting. A client, who was fishing in the Northern Territory, reported having the whole box completely filled with fish fillets, to the extent that not another one could be added and that every fillet was frozen solid.



**C7.** There is a range of solar panel options that can be tailored to your need. A set of panels could be mounted on the top of the nosecone/storage compartment so they could be used in that position, but with a special attaching method that would allow them to be removed and repositioned at a distance from the van.

**C8.** There may be a requirement to have a PowerPoint in a different location.

**C9.** The inverter will change 12 Volts direct current electricity, to 240 Volts alternating current electricity. In other words, it changes the electricity that is normally supplied from the battery into the same sort of electricity that is found in an Australian home. You can plug into an inverter to charge a mobile phone with the same plug that you would use at home. There are inverters available with sufficient capacity to operate appliances with a high power requirement such as a microwave oven, but there is not sufficient energy available in one or two batteries to make this a viable proposition.

Appliances such as a 12V/240V TV or a laptop can be operated by plugging directly into a 12 V supply using a particular chord designed for that particular appliance. Each chord has a transformer built into it to convert the 12 V DC current supplied by the battery to what is required for the particular appliance. As the appliances would already be designed to plug into a 240 V ACs supply it is usually much cheaper to buy a small 12V – 240V inverter than to buy the special cord for each appliance.

On a SAFETY NOTE -remember the inverter produces electricity at about 240 V and just like the 240 V mains supply, it can cause death.

An Inverter should not be left switched on when the vehicle supplying the 12 V current is being started. This is because the surge of current required to start a vehicle can drop the voltage down below 10VDC. After the vehicle has started, it will surge back up to 12-13.8VDC and the combination of these 2 surges can damage the Inverter and/or appliance.

An 150 W inverter can be connected to the electricity supply with a cigarette lighter type plug but the higher capacity units need to be permanently wired with heavy cable to the battery.

## Modified Square Wave (MSW) Inverter

Most appliances will work from Modified Square Wave (MSW) Inverters, but unfortunately unless you can look at the internal electronic design of the appliance, you can't be sure if you will really need a Sine wave Inverter. The squarish wave shape can also confuse the timing circuits in some appliances that use the Mains Frequency to control a clock. If the appliance doesn't work normally or makes unusual noises, then disconnect it or you may have expensive damage. These Inverters also generate more interference to TV and AM and HF radio reception than Sine wave Inverters and can cause buzzing in CD players.



Example image reference - [http://caravansplus.com.au/catalog/product\\_info.php?products\\_id=13868](http://caravansplus.com.au/catalog/product_info.php?products_id=13868)

## C10. Sine Wave Inverter (Please read the general notes in C8 first)

Sine Wave Inverters are more expensive than Modified Square Wave because more components are needed to electronically generate the Sine Wave. If the appliance has a Transformer or an Induction Motor, then it most probably needs a Sine Wave Inverter to prevent overheating. Computers are normally fine as they have Power Packs specifically made to limit fluctuations.

The manufacturer claims that the Victron Phoenix inverter pictured below is designed to output pure Sine Wave AC power which is perfect for sensitive electronics and so is suitable for the widest range of applications.



Reference image - <http://www.victronenergy.net.au/>

**C11.** The 240 V wiring circuit is completely separate from the 12 V wiring circuit. Power points in a caravan are required to be double-poled which makes them more expensive than those normally used in a house wiring circuit. In the XC caravan, the normal 240 V circuit has an external power inlet on the side of the van to enable a flexible lead from a 240 V supply such as a caravan park power box, home power point or generator, to be connected. The standard arrangement in the XC is that appliances can be plugged into a double power point inside the caravan in the front storage compartment under the table. There is an option to have an extra power point located on the left-hand side of the main entry door or possibly in some other location.

**C12.** The Air-conditioner unit suggested for use in the XC caravan is the Dometic Truma Saphir Comfort ducted, reverse cycle unit with a remote control. The air-conditioner would be mounted between the two floors behind the gas storage compartment and the cooled or warmed air would be ducted into the living space.

This would be much quieter than having an air-conditioner mounted on the roof. This unit is designed for caravans up to 6.5 m in length so would have abundant capacity to cater for the Innovan XC even with the extra headroom. Dometic offers 12 months' warranty on parts and labour. Reference images and feature list - <http://www.truma.com/>



**Features:**

- Extremely powerful, yet also very quiet
- The lightest in its class
- Convenient remote control
- Practical timer function for automatic switching on or off
- For vehicles up to approx. 6.5 m

**C13.** The CTEK MXS 7.0 replaces the multi-SX 7000. When connected to a 240 V ACs supply it is capable of charging a variety of 12 V batteries. It features reverse polarity protection, non-sparking clamps and comes with CTX recondition mode to help revive heavily discharged or sulphated batteries. It also features the CTEK patented eight step fully automatic charging system that allows 100% charging of lead acid, gel, AGM, deep cycle, sealed and calcium batteries. It has an IP 65 rating for protection against dust and water. At the time of compiling these notes the MXS 7.0 is supplied with a five-year warranty.

**C14.** Extra power points can be fitted in certain locations.



Image reference - <http://www.ctek.com/int/en/chargers/MXS%207.0>

## Section D

**D1.** The Innovan” Innoshield” awning system has been patented. Its special features are that it can be pulled out in a couple of seconds, it locks in position with the assistance of two gas struts and it is then ready for immediate use. In most weather conditions it does not need any extra support.

For cyclonic conditions, braces made from aluminium tube with end fittings can be attached from near the centre of the side arms to the bottom back corners of the van. For rainy conditions, a hoop can be inserted across the middle of the awning so that water does not collect.



**D2.** The first XC caravans produced did not have Rhino Liner surfacing, but after extended use on stony services there was some evidence of stone marks on these units. It has now been decided that a couple of options will be offered to those clients who want to prevent this happening.

Although not cheap, the Rhino Coating seems to be an effective option and is also an attractive addition to the unit. The main purpose of this coating is to prevent chips in the gelcoat caused by rocks being thrown up from the wheels of the towing vehicle or by other passing vehicles. Because of the angle of the front of the XC, stones are not bounced back to break the rear window of the towing vehicle as they often are with other types of stone deflectors. Also, it does not have the significant wind resistance of other stone deflectors currently on the market.



**D3.** The sliding windows used in the Innovan XC are manufactured in Australia by CAMEC and have tinted safety glass, internal locking mechanisms and insect screens.



**D4.** The door to the toilet's storage area is specially constructed so that when it is opened and the top edge rests on the floor, the toilet drawer lid, which supports the chemical toilet, can be rolled out to rest on the toilet storage door. This allows the weight of the toilet and a person to be fully supported, so that the drawer runners are not damaged when the toilet is being used.



**D5.** The top compartment of the toilet unit contains water for flushing and the bottom part has a very effective seal to prevent any odours escaping when the toilet is not being used. The toilet is located in an area where the refrigerator fan blows air around it and out through a vent to the exterior of the van when the caravan roof is raised.

The hold-down brackets are there to stop the toilet moving around while traversing rough terrain.



**D6.** The suspension could be set for a particular trip with a particular load and left unchanged. However this kit allows, with the touch of a "switch", the raising or lowering of either side of the van, so that it can be levelled for cooking or sleeping. The whole van can be raised for crossing creeks or obstacles or rutted tracks or even to give extra head room clearance under the awning.

The high-capacity air pump with the hose and wand is available for re-inflating tyres on the vehicle as well as the van after crossing sand. Of course, with the aid of the hose and the quick release fitting supplied, it can also be used to operate air tools.



Image and reference need to be updated...

**D7.** This water filter is placed in the area under the sink and the water that passes through it is accessed with a dedicated tap in the vanity recess. If the option D8 is included, then water can be filtered on the way into the tank or on the way out, or both.

This particular filtration system has the superior characteristics of combining 0.2  $\mu$  ceramic dirt and sediment pre-filter and a stack second stage CRPB 0.4  $\mu$  coconut carbon filter cartridge with a flow rate of up to 8 L per minute.



Filter cartridge life will depend on water quality and usage, but unlike other caravan water filter systems available, the first stage ceramic filter can be taken out and cleaned with a Scotch-Brite cloth to restore the flow rate and extend the time between cartridge changes. The supplier states that the system will remove bad tastes and odours, chlorine, dirt and sediment, colours, rust, slime, algae, bacteria, E. coli, viruses, Giardia, Cryptosporidium, scale, salts, calcium, heavy metals (e.g. lead), pesticides, herbicides and more.



**D8.** The advantage of having this plumbing system is that water from an external source, such as a creek or a bucket, can be pumped into any one of the water tanks or used directly through the shower outlet. The system includes a number of taps to direct water flow. It also includes a plastic suction hose of sufficient length to reach the ground as well as a fitting which allows connection of a garden hose to the inlet side of the pump. It provides a facility for water supplied from a hose to be passed through the filter before going into the tanks.

Circumstances might arise when shower water can be heated by the Sun or a campfire and this plumbing system, with the help of a bucket, allows this heated water to be used in the shower. It simplifies filling a tank or tanks from a creek. It provides a safer method than that of using a bucket to obtain water from a water source which may contain dangers such as crocodiles.



**D9. The vinyl shower cubicle** is a purpose-built accessory that can be unfolded and hung under the awning. It is about 1800 mm high and has an opening on one side to fit against the vanity recess. A good quality zip is at one corner and across the bottom of one side to form a door which can be folded back under the awning. It has a fixed floor and a fitting which can be connected to a hose to drain water away. It provides privacy and protection from cold winds.



**D10.** The awning extension slides into a sail track fixed to the roof so that it can hang down to the ground over the three sides of the fold out awning. These can be pegged to the ground to make an enclosed area at the back of the slide on except for the area underneath the vehicle. The sides can be extended out horizontally and poles inserted at the edges with ropes pegged to the ground to hold the poles upright. One, two, or all three sides can be lifted up to form a shaded area.



**D11.** The inserts fill the space between the two beds so that the mattresses can be turned sideways and then pushed together to form a bed which is the width of a Queen-size bed. The mattresses would be 1880 mm long but when placed crossways there would be an extra 150 mm of length available, so with a pillow over the gap, the length available would be greater than that of a Queen bed.



**D12.** This bracket is designed so that the awning can be pulled in to a point where there is just sufficient room for the door to open and when the bracket is clamped to the arms of the awning, it holds it rigid and retains the strength of the awning. With a shortened awning there will be less buffeting of the van or flapping of the vinyl if strong, gusty winds were being experienced.



**D13.** The stainless steel spring support arm can be fitted to the storage compartment doors so that they are held in an open position as the spring coil becomes a rigid support. To close the door side pressure can be applied to the middle of the spring and the support will collapse allowing the door to be closed. This is particularly useful to keep the doors open in windy conditions or to prevent the doors from slamming against the face of the unit and bending the hinges.



**D14.** These window covers slide into a sail track fitted above the window. It is supported by aluminium struts and rubber straps.



**D15.** An insect screen with magnetic tape around the edge can be attached in the doorway to prevent entry of insects if the door is left open.

**D16.** Replacement filter cartridges.



**D17.** A carry rack to suit individual requirements can be fabricated so that it fits on top of the front storage compartment.



**D18.** There are a number of different off-the-shelf awnings available that could be mounted on the side of the roof underneath the window.



**D19.** Sail track could be mounted in a number of locations to suit individual requirements.



**D20.** The informed opinion seems to be that electrically connected rear vision cameras are much more satisfactory than radio controlled ones, so we offer the option of attaching one to the back of the van in the area under the door. The wires lead to a plug at the front of the caravan. The other half of the plug together with a 5 inch LCD monitor and wiring is supplied, so that the monitor can be fitted in a convenient location in the vehicle



Rear vision camera footage from a recent Cape York trip.

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## Section E

**E1.** For those who would prefer them, off-road drum brakes are offered as an alternative to the disc brakes and would normally be used in conjunction with the coupling that was not an override coupling.



**E2.** These ROH wheels have been tested satisfactorily in the Dakar Rally and look great.

**E3.** There could be an advantage in having wheels that could fit both the towing vehicle and the caravan, in that any spares available could be used on either unit. This option depends on availability.



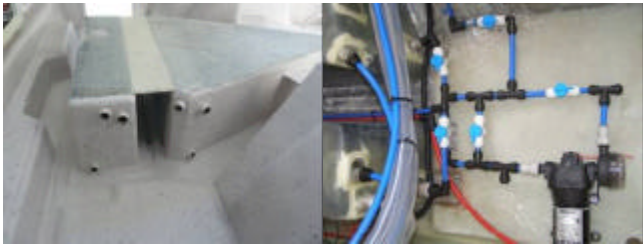
**E4.** The AI-KO power move is ideal for manoeuvring the caravan into tight places or over soft ground.



**E5.** The Linak LA36 actuators are arguably amongst the most advanced models from the world's leading manufacturer of actuators. They have heavy-duty aluminium housing for harsh conditions and are protected against dust and water to the extent that they can be washed down with a high-pressure cleaner. They allow the roof to be raised or lowered using a toggle switch. A hand-held remote is available at extra cost.



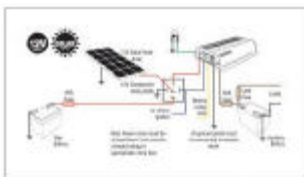
**E6.** Some people may have an application requiring a grey water tank and may prefer to have that rather than the capacity to carry extra drinking water.



**E7.** Having a hot water system operated by 240 V could be advantageous for people with a generator or if mains power was available.



**E8.** The BCDC 1240 can produce enough current to charge two batteries at the same time at a rate which is close to the maximum that would normally be desirable and has the special feature of having a built-in MPPT solar regulator for use with solar panels. As well, it is a Start Battery Isolator as well as a Multi Stage DC – DC Battery Charger which will fully charge AGM, Gel, Calcium content, VRLA and standard Lead Acid batteries. It is fully sealed and super quiet when operating.



**E9.** The CTEK MXS 15 has the capacity to provide more than twice the current of the MX S7 and so should be able to charge a battery in half the time needed by the smaller unit.

The following summary and images have been extracted from: <http://www.ctek.com/au/en>

MXS 15 is a reliable power charger for 12V. It works just as well in the outback as in the city whether the situation requires quickly and safely charging a battery or long-term maintenance charging. The charger is as effective in workshops as on caravan or boat outings. Several chargers can be connected simultaneously if a higher charging current is required. It has functions that examine and show if the battery can be charged and maintain a charge, a special reconditioning function that restores stratified and deep discharged batteries, unique maintenance charging as well as a temperature sensor for optimised charging no matter the weather conditions. MXS 15 also has a feed function enabling the battery to be disconnected from the vehicle without losing important settings.

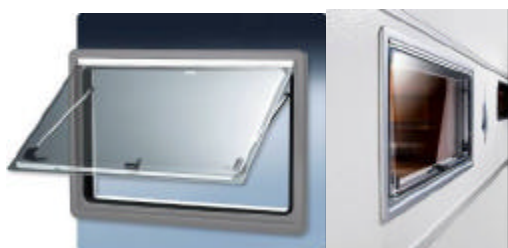
MXS 15 is a completely automatic 8-step charger that gives 15A to 12V batteries between 40 and 300Ah. The charger has an IP 44 rating (outdoor use), protects vehicle electronics, produces no sparks and is polarity reversal and short circuit proof. It is supplied with a 2 year guarantee.

IP44. 230V. Capacity 40-300Ah. Charge current 15A. Dimensions 234x130x63 mm (LxWxH).Weight 1.9 kg. Suitable for all types of 12V lead-acid batteries (Wet, MF, AGM, Ca/Ca and GEL). Temperature range -20°C to +50°C.



**E10.** These Dometic windows are hinged at the top and have telescopic arms which allow easy opening and setting into various positions. Other features include robust quality with double acrylic borderless glazing, maximum security, ADR approval for use in recreational vehicles, a fine insect screen and a block out blind with a light grey interior and a reflective aluminium exterior.

These windows are larger than the sliding windows that are now available. They differ from the sliding window in that the whole window area can be opened rather than just half and they will let in less rain if left open when it is raining. The downside is that they protrude from the side of the van, in a specially built housing, by an extra 60 mm.



**E11.** This door is an option for people who don't want a toilet and the special supporting door and don't want the slide out platform but would still like access to this area from inside the van.



**E12.** The digital pressure gauge gives a more accurate reading.



**E13.** Some people might prefer a larger screen.

