

# An Auto-electricians Guide to Installing Solar - an ongoing series



Collyn's office

There are many causes of RV solar disappointing, including that you will inevitably encounter systems that are competently scaled and installed, but do not perform as their owners reasonably hoped. The causes are various but the more common are covered in this part of the series.

A common explanation of how this has come about is that such systems are likely to have been installed by people who knows about electrics and/or solar, but not that it is not feasible to fully charge auxiliary batteries successfully directly from a vehicle alternator unless driving for many hours.

Whilst replacing inadequate cabling assists, dc-dc alternator charging is so much more effective it now makes no sense to take any other approach.

These systems need installing as close to the auxiliary battery/s as possible, but it is not uncommon to find them located next to the alternator - yet attempting to charge a battery in a caravan. Also (and with respect to their various makers), dc-dc alternator chargers work even better if used with cable larger than specified, particularly if caravan located. Some vendors stress this need.

Whilst dc-dc alternator charging compensates for voltage drop, it appears to be commonly overlooked (at least by private buyers) that this necessitates drawing more current (to compensate for energy lost as heat in too small

cabling), thus further increasing heat loss. The system is likely to work better than without that unit, but not as well as it would with adequate cable, because it limits current drawn. Further, in extreme cases, the alternator may not be able to supply that required.

## Poor Fridge Installation

A further and major cause of electrical woe is a common misunderstanding of how electric compressor fridges work (e.g. Engel, Waeco etc). The common belief is that they are a sort of negative version of an electric heater – that somehow generates cold. The reality is that they are pumps that shift heat from where it is not wanted to somewhere that heat does not matter.

There are two main causes of their not doing this as well as they can. Both

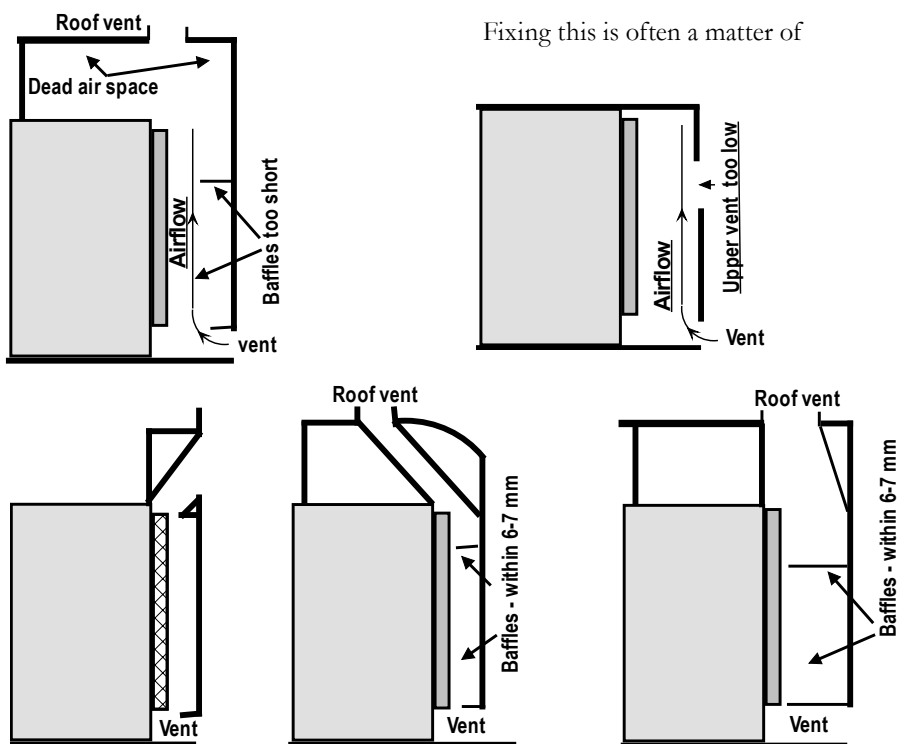
causes are more common than not.

The first that the heat pump (i.e. the fridge's compressor) lacks the full voltage required. If DIY installed it is odds on that, if 4 mm<sup>2</sup> cable had been specified, that which has been used is 4 mm auto cable (a probable 1.8 mm<sup>2</sup> – 2.0 mm<sup>2</sup>). Further, that overall cable length is often longer than specified in that requirement.

To correct this - nothing succeeds like excess. Use 6 mm<sup>2</sup> - or 8 mm<sup>2</sup> for cable lengths over three metres. It is overkill but if you do this, electric fridges work much better.

The second cause (and most fridges suffer from both) is lack of adequate, or any, provision for enabling cool air to flow through the unit's cooling fins: nor for unwanted heated air to flow to the outside of the RV.

Fixing this is often a matter of



How to install a fridge correctly. Cold air needs to enter from below the cooling fins and directed by baffles so that it can pass only through those fins. These baffles must extend to within 10-15 mm of the fins. Hot air must be channelled to the exit vent. An extractor fan (run directly from a 5 watt solar module, i.e. a battery is not required) further enhances cooling.

**Top left:** too short baffles causes incoming cool air to bypass the cooling fins; rising hot air is trapped, hindering air movement. **Top right:** upper vent is too low, trapping hot air above it.

**Bottom:** How it should be done. An extractor fan helps shift the hot air - but use baffles too. Drawing and text copyright © 2012 Caravan & Motorhome Books, Church Point, 2105.

installing a vent or two, but usually time consuming and thus costly. Sometimes however installation is so inept that a fridge is totally enclosed. The unit must not only cool its contents. The heat it generates must readily escape.

It is far from unknown to find a fridge installed in a totally sealed locker or cupboard. In addition, it is almost routine to find them almost totally enclosed in the rear of a 4WD.

Capacity (litres)	Vent (cm <sup>2</sup> )
Up and including 100	32.0
101-200	45.0
Greater than 200	65.0

Table 6.1 of AS/NZS 5601.2010 (redrawn). Whilst obligatory only for gas/electric three-way fridges, these vents sizes work well too for electric only fridges.

The fridge will cool to a minor extent, but may even run continuously, drawing full power 24/7. Unless this issue is addressed no fridge will ever work even remotely as it should.

I have shown how installation should be done, in a past edition of this journal, but is included again for convenience.

In many cases, this work can be done by the owner – as long as he/she is made adequately aware of its need.

Where the unit is not bolted down, a quick demonstration is to have the owner remove it from the RV and see how differently it performs on a cool garage floor. (I also suggest they read my article on this (under Articles on [www.caravanandmotorhomebooks.com](http://www.caravanandmotorhomebooks.com)).

### Microwave Ovens

Microwave oven draw tends to confuse because their 'rating' (typically 800 watt) is of the heat energy they produce, not as many owners will believe, of the energy they draw.

Most such are only 50%-55% efficient, so an 800 watt unit is likely to draw around 1200 watts (100 amps at 12 volts). As all are 230 volt ac (a few have inbuilt an inverter) the latter's losses must also be taken into account. Most lose at least 10%, the older square wave units up to 15%. So we are now looking

at a typical 1350 watts – close to 140 amps at 12 volts.

Leaving aside that few solar installers realise the cable size needed to carry that 140 amps, no deep cycle battery bank of less than 500 Ah appreciates such high current draw (yet many attempt to do that with under half).

Here, AGM and gel cell batteries are a far better choice.

Owners typically overlook that fifteen minutes use is 21 Ah, in many cases a third or more of the day's solar input: I advise in my books and general articles that it makes little sense to spend \$1500 or more to run a \$199 microwave oven: and to consider using it only where there is mains power – or from a hopefully quiet 2000 watt generator.

### Incandescent Lighting

Many older RVs still have energy gobbling 20 watt incandescent or halogen globes (often eight or more) and less than adequate cabling.

Both issues are readily fixed by replacing the globes (and sometimes their holders) by 5 watt LEDs. Warm white versions produce light of both the colour and brightness of a similar wattage incandescent. As current draw is slashed by 75%, voltage drop on the wiring is no longer an issue.

### CPAP Machines

A yet further cause of solar dismay is not realising how much energy is drawn by CPAP (Continuous Positive Air Pressure) breathing aid machines used by many older RV users whilst sleeping.

Recent non-heater units draw about 1.5 amps (at 12 volts) but via an inverter that will draw up to 15% more. Older ones may draw five or more amps, as do those

that have heaters and/or humidifiers.

This is too specialised a topic too cover here, but my article on the subject also can be accessed (click on Articles) at my main website: [www.caravanandmotorhomebooks.com](http://www.caravanandmotorhomebooks.com).

### Learning More Now

Our auto electricians' offer for the 3rd edition of *Solar That Really Works* is extended until further notice. It is also extended to the all-new *Caravan & Motorhome Electrics* that covers every aspect of the topic. The offer is also available to TAFE and TAFE students.

As many companies order in quantity for their staff we extend a further discount for two or more books.

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This series will eventually be expanded and totally rewritten - and offered in digital and possible printed form.

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This solar modules rack is an optional extra with Track Shack camper trailers: simple and effective if the trailer is parked to face North.