Inverters Update

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Until the 1980s or so, caravan and motorhome owners used electricity primarily for pumping water, lighting, the radio and perhaps TV. The few amps required were drawn directly from the vehicle's 6 or 12 volt starting battery.

The consequently flattened starter batteries were not as big issues as today because most cars back then had a starting handle as back up. The more enlightened added an auxiliary battery that was either charged before leaving home, or was charged whilst driving by the dynamos of those days.

As boats tended to be much the same, there was a big market for 12 and 24 volt dc appliances including TVs (six volt systems had all but been abandoned by the 1960s). Whilst often a bit crude in design, these appliances were generally very well made,and electrically efficient.

Caravan Park Supplies

Caravan parks progressively installed 240 volt supplies and, as that happened, some caravans and motorhomes either installed dual voltage wiring (and a few still do) and/or continued to run on 12/24 volts with batteries fed by an inbuilt battery charger.

This type of inverter is hard-wired into the RV's mains wiring system..

But even (or especially) back then, far from all wished to stay in a caravan park. But, by then, camping by candlelight or gas lantern was losing its appeal. People sought electricity without a 30 metre umbilical power cord.

Eventually solar proved a viable alternative to the limitations of pre-charged batteries, and hideously noisy generators. It also began to make sense to use 240 volt ac power for TVs etc.

Early Inverters

Ways to generate mains-voltage ac from battery banks using big dc motors coupled to ac generators had existed since the days of Edison and Tesla. Then, in 1925, David Prince invented the 'inverter' (Prince's original term). This did much the same as a motor-generator but using basic (valve-based) technology. The original inverters were big and clumsy, rarely-used, only 60% or so efficient, but silent and reliable.

Their development progressed and by the early 1980s they began to be used in solar power systems etc. Even by 2000, solid-state based inverters were producing cleaner than grid power, cost less than $1 per watt, and of some 90-92% efficiency (now up to 95% or so).

For caravan and motorhome builders and owners, it made sense to use appropriate 240 volt appliances: lighter, cheaper, often more energy efficient despite the inverter loss. And with *hugely* greater choice, but rarely alas, as well made.

An inverter thus provides a wider choice of appliances, but for RV use, lighting and refrigeration and water pumping are still done more economically via 12 volts (this may change: as RV fridges now seriously lag the latest 240-volt domestic units.) But for all else: Next G modems, laptop computers and printers, TVs, electric razors, cameras and other small devices, using 240 volts makes sense.

Sine waves

Today's inverters convert 12/24 volts dc into 230/240 volt ac, in either of two different ways. The first are misleadingly marketed as 'modified sine-wave'. These in effect chop the direct current into small square lumps with their corners vaguely rounded off. These inverters *will* run most mains-voltage appliances but it's like running your Porsche on kerosene and some items (particularly laser printers) are likely to be destroyed by them. They are also likely to produce a hum on audio gear, and lines on TV screens. There *are* a few good ones, but all are best avoided unless the *inherent* limitations are totally understood.

I strongly advise to use only true sine-wave units: their output is cleaner, more reliable and far more voltage stable even than grid-supplied power. Even here there are degrees of quality and particularly efficiency. Stay with major brand names bought from reliable suppliers. Chain-store specials are just that!

Wired In - or Free Standing

Apart from true sine wave output and the variously deceptive descriptions of those that are not, there is one further category that *is vital* to know about.

The generally smaller (<350 watt) units are mainly intended to be used as essentially portable free-standing power supplies. You connect them across a battery and plug your 240 volt appliances directly into their inbuilt socket outlets. They are not designed for, and are not suitable for, connecting in any way into a caravan or motorhome's fixed wiring. It is both *extremely* dangerous and rightly illegal to do so.

Larger inverters for RV and property use are intended to be hard-wired into (appropriate) mains wiring. Their input thus goes through the same circuit breakers and RCDs as does the mains input, but with an essential and obligatory switch that ensures inverter output can never be fed into the grid side of the supply.

Revised Standards

This methodology has recently been revised. It is now clearly set out in both AS/NZS 3000:2007 and AS/NZS 3001:2008. (The Standards now cover both local and remote MEN inverter and generator connections).

Grid-connect systems have similar automatic provision: inverter power is shut down unless mains power is there too. (In standard such systems, the solar generated power is shut down too.)

Auto-electricians and the electrically knowing may legally install the 12/24 volt dc side of an inverter installation (which is *all* of the installation for stand-alone units. Only a licensed electrician may legally connect an inverter to the vehicle system fixed mains voltage wiring.

I probably need to repeat the warning not to connect a stand-alone inverter to the fixed wiring by *any* method: the risks are very high and are also invariably misunderstood.

Inverter Sizing

Unlike most other electrical devices (usually rated at their maximum continuous output) inverters are *designed* to deliver more., and often a lot more, for a short time. This is because

This is a free-standing inverter. These must not be connected into an RV's fixed mains wiring.

many electrical devices, particularly motors, draw heavy currents whilst starting. A typical 350 watt inverter may supply twice that for some seconds, and 500 or so watts for ten minutes or more. Much like camels, if seriously overloaded they rest awhile to recover.

Size required depends mostly on whether you have a microwave oven. The power they draw is higher than most people realise. Their wattage rating is of 'cooking power' - a nominally 800-watt oven actually draws up to 1360-1400 watts, allowing for inverter losses. Five minutes usage is not a big dent in consumption for a big motorhome system, but that $199 oven may over $1500 more for the 1200-1500 watt inverter, and larger battery capacity to cope with the 120-130 amp draw. That's a lot of money for heating up a frozen chook in Hobart.

Inverter/Chargers

Combining the functions of charging and supply makes sense technically, but not always practically as with most such units, only one function, or the other, is available at a time. You either watch TV etc - or charge the battery, but not both at once. For some this matters not, but not all are aware of this possible limitation.

Collyn Rivers is an ex automobile research engineer, and now a globally published writer. His books include *Motorhome Electrics, Solar That Really Works* etc, and the just-released Edition Two of the top selling *Campervan & Motorhome Book*. Most are available directly from CMCA NHQ.