

## **Battery Charging Basics** – *by Dave Parsons*

Following is based on my experience with the Magnum inverter/charger and remote on my 2006 American Tradition. Newer coaches will most likely have the same equipment, possibly with a newer version. Anyone with an older coach may have a different system, but the basic operation should be similar.

We often hear the expression that someone will start the generator, or plug in the coach, or start the engine, to charge the batteries. Although we all understand what is meant by these terms, they are all mostly incorrect. Yes, this is being nit-picky, but to understand how these systems work, and be able to do basic troubleshooting if all your batteries are not being properly charged, you must know how the process works.

First, let's talk about normal charging from shore power. This is pretty straight forward as the shore power provides 120 VAC to the main power panel, and then through a 30 amp circuit breaker provides 120 VAC power to the inverter/charger. In this mode, the inverter section is disabled, and the charger is energized to convert the 120 VAC to 12 VDC to charge the house batteries. Note I said house batteries. That is HOUSE BATTERIES ONLY. The battery charger does not charge the engine start batteries. I will explain how the engine batteries get charged in a minute.

Next, if not on shore power, you can start the generator. But the generator DOES NOT charge any batteries either. The generator supplies 120 VAC to the main power panel, and, as above, through the 30 amp breaker to the inverter/charger. And the HOUSE BATTERIES ONLY are charged as above.

Lastly, when leaving the campground, shore power is gone, and there is no need to start the generator, the engine alternator will supply 12 VDC to all the coach 12 VDC operating needs, as well as for charging the engine start batteries. Again, that is ENGINE START BATTERIES ONLY.

Note that in each of the above 3 examples, only one set of batteries is being charged. When 120 VAC is available, the battery charger is charging the house batteries only. When the engine is running, it will charge the engine start batteries only.

A completely different and separate component called the Battery Control Center (BCC) is provided to manage the charging of the "other" set of batteries. It is basically a simple controller that will do little more than open or close the "Big Boy Relay". This relay is simply a heavy duty relay that, when closed, will directly connect the hot side of the house batteries to the hot side of the engine start batteries using heavy duty battery cables. This relay will close when either battery bank reaches or exceeds about 13.3 VDC. Newer coaches may have a "Charging Relay" in lieu of the BCC & Big Boy relay. It does the same function, so does not affect any of this discussion.

For example, when you plug the coach into shore power, or start the generator, the charger will quickly go to about 14.3 volts in the first stage. Thus the Big Boy relay should close very quickly after charging is started, to let the house battery voltage and current pass on to the engine start batteries. If the house batteries are low, it may take a bit longer for the BB relay to close, but if you have just come in off the road, all batteries should be fully charged from running, and the alternator charging all day.

When traveling, the engine alternator should put out about 13.6 volts. More than enough to close the Big Boy relay, and charge the house batteries from the engine start batteries. Thus you can see that all batteries should be fully charged at all time. The obvious exception being when dry camping, or any other time when you have the engine off and no 120 VAC available. Books are written about dry camping, and how to handle the battery problems.

The most obvious and common problem with all the above is the Big Boy relay staying open when it should be closed. Actually the Big Boy relay normally stays closed about 99.9% of the time. It would normally be open when dry camping (if you do that) and between the time you unplug the coach and start the engine. Or shut down the engine and plug in the coach. The Big Boy relay will normally open if the batteries drop below about 12.8 VDC. If your charging system settings are incorrect, it is very possible the float voltage will be below the 13.3 VDC required to re-close the Big Boy relay, and the engine batteries will never get charged, and the all too common complaint that the engine batteries go dead. Bad house batteries can also cause this, but if you watch carefully, you will probably note unusually high charging current feeding that bad battery, which may keep the float voltage too low. Normal float voltage to satisfy the Big Boy relay is about 13.5 VDC. Viewing this, the type of battery you are using becomes irrelevant, as you must set the battery type to AGM2 to achieve the voltage required for the BB relay.

Another sneaky problem is the SHORE setting. It should always be set to 30 amps. However if you are plugged into a 15 amp or 20 amp outlet, this may be changed accordingly, and watch your charging system carefully. If this is set too low, or you are using more power elsewhere on the coach, it will shut off the battery charger in its attempt to prevent tripping the shore breaker. And don't forget to reset it to 30 when going back to 30 or 50 amp power supply.

As you can see, with this system, there is no need to add any further or supplementary charging systems. If your system is not working as above, you are far ahead to get it fixed, rather than making unneeded additions or changes. Two wrongs don't make a right!

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